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*Illustrated.

Philadelphia Suburbanites Quickly Appeased

The Public Service Commission of Pennsylvania, in its decision on Philadelphia suburban ticket rates (reported in our news columns) has set an example of promptness and good sense from which some dozens of other commissions might learn a profitable lesson. The advances announced by the railroads a month ago made a great furore, if we may judge by the sensational columns of the newspapers. The general agitation may have been looked upon by the commission as a reason for haste. Again, the question at issue was quite simple, making promptness easy. Nevertheless, the commission's action must be classed as praiseworthy, if only because dilatory tactics are so common—not to say universal. Questions that are simple often seem to become complex just because they are taken into a commission's office. This case was simple for one reason, because a clear course of action was available, whatever differences of opinion might exist among the commissioners. The railroads for years have carried occasional passengers at about the same rate per mile as the commuter who travels every day; an abnormally low rate. A hundred rides a year, say one round trip a week, could be bought for one cent a mile. The carriers abolished this 100-ride ticket and the passenger found his fare more than doubled. The passengers' remonstrance was very loud, *of course*. The order of the commission is that the tickets shall be continued at 1½ cents a mile, and to be used in six months; which may be interpreted as a decision that, whatever the merits of the case, the shock to the passengers must be softened, postponed, divided; which is plain common sense. The people have encouraged trolley lines, greatly depleting the steam roads' profits. This, and the abuse of commutation tickets by petty frauds, constitute good reasons for abolishing the low-rate tickets; but in such a violent change the element of time is important.

Fatal Collision on the Manhattan Elevated

The Interborough Rapid Transit Company of New York City is not subject to the Interstate Commerce Commission, as it does no interstate business; but it has troubles of its own. There was a collision on one of its elevated lines last week, killing a passenger; and forthwith the newspapers demanded steel cars. It does not appear that the loss of life or the distress would have been materially less if the cars had been of steel, but the steel car affords a simple and direct issue—every one knows something of the horrors of fire—and so it must be made prominent, to show how the newspapers love the people. The people would have to stand the burden of the cost of steel cars; it would take $17,000,000 to provide enough steel cars to take the place of the wooden ones now in service, and another seventeen millions would have to be spent to strengthen the elevated structures for heavier loads; but what of that? Shall not safety be secured, whatever the cost? It is to be admitted that any passenger, any city editor, might freely approve the expenditure of thirty-four millions to protect his own individual person; but why should not the few conservative newspapers speak out, on an occasion like this? There are two facts, ignored or minimized by the press, which greatly modify this question of safety on the elevated lines (where, for all trains, at all times, the rule is to run with speed under control). First, the percentage of safety is very high; this is the third collision, fatal to passengers, in the history of the crowded Manhattan elevated lines—about 36 years. Second, the cause of the collision was very plain, making the lesson, as regards precautions, quite clear. The conductor, acting in the place of the motorman as lookout, was not sufficiently cautious in performing an unfamiliar duty. Comparatively unimportant auxiliary causes may be brought out, on further investigation; but there seems no question that adequate training of the men, so that complications due to unexpected failures of apparatus would not be unfamiliar, would provide all reasonable precaution against this kind of error.

THE VALUATION OF RAILWAYS

THE recent statement of Director Prouty of the Valuation Department of the Interstate Commerce Commission that the valuation of all the railways will cost $50,000,000, and the reported estimate of a member of the commission that it will take ten years, have called forth unfavorable comment from the press. The Wall Street Journal indorses the plan suggested by some railway officers, of having a valuation made of only certain roads, and thus testing the practicability of valuation as a basis for regulation of rates, before carrying out the scheme in its entirety and incurring all the expense this would cause. The Savannah (Ga.) Morning News of November 24, in referring to Mr. Prouty's remarks, denounces the whole valuation plan. Its cost, the News points out, will be much greater than its advocates anticipated, the time required to make it will be much longer; and when it is done the data on which it is based will be such ancient history that no court will accept it as a basis for fixing rates.

The *Railway Age Gazette* always has thought, and thinks now, that the theory of valuation as the proper basis for the regulation of rates is false. When the question whether a scale of rates fixed by public authority is confiscatory is an issue, valuation may be the best basis on which to settle it. But regulation ought to be such that the question whether rates fixed by it are confiscatory will very seldom be raised. If regulation is to be such that the rates made by it will constantly raise the question of confiscation, then a valuation kept up to date will be useful, but only because the system of regulation is wrong in principle; and such a system cannot endure.

Furthermore, a valuation is unnecessary to convince any fair and reasonable man with any knowledge of railway affairs that as a whole the rates in every section of this country are too low. It is almost universally conceded that the railways should be allowed to earn a net return of 6 per cent on a fair capitalization or valuation. On what capitalization or valuation would the net operating income of recent years yield 6 per cent? The following table gives for the last three years the net operating income per mile of the railways of the United States and those of each of the large sections of the country, and the amounts per mile of capitalization (or valuation) on which the net operating income would have yielded 6 per cent:

	1912		1913		1914	
	Net operating income per mile	Net operating income per mile capitalized at 6 per cent	Net operating income per mile	Net operating income per mile capitalized at 6 per cent	Net operating income per mile	Net operating income per mile capitalized at 6 per cent
United States.....	$3,045	$50,750	$3,680	$61,333	$3,094	$51,566
Eastern District....	5,264	87,733	5,802	96,700	4,443	74,050
Southern District..	2,226	37,100	2,669	44,483	2,588	43,133
Western District...	2,398	39,960	3,016	50,266	2,630	43,833

The *gross* capitalization per mile of our railways in 1912 was over $81,000 a mile; their *net* capitalization—arrived at by elimination of all duplications caused by incorporate ownership of securities—was $63,500; and yet in 1912 their net operating income would have yielded 6 per cent on only $50,750 a mile; in 1913 on only $61,333 a mile, and in 1914 on only $51,566 a mile. Would any engineer of reputation say that the railways of the United States could be reproduced for any of these amounts? Is there a single engineer of reputation who would say the railways of the West could be reproduced for $39,960 to $50,266 a mile, or those of the South for $37,100 to $44,483 a mile, or those of the East for $74,050 to $96,700 a mile? Even the government-owned railways of New South Wales are shown, by their latest report, to have a capital cost now of $75,000 a mile! It is not necessary to wait for the valuation to be finished to find out whether the rates of our railways are too low and their net return too small. Everybody who has studied the facts, and brought to their study enough brains to add 2 and 2 together, and enough fairness to admit, when he has done so, that the sum is 4, knows already that the rates and net return are too low.

Why, then, go on with the valuation? Must we spend ten years and $50,000,000, and perhaps even a great deal more in proving what every real student of railway matters knows already, viz., first, that on the whole rates are too low in this country, and, second, that valuation can never be made really serviceable in the fair regulation of rates? If it is necessary to make a wholesale valuation to prove to the public what every real student of the subject knows, perhaps we should go ahead with it; but the price is a very high one to pay for a form of popular education which it ought to be possible to secure a great deal cheaper.

"EFFICIENCY" IN THE POST OFFICE DEPARTMENT

THE postmaster general in his annual report, sent to Congress this week, congratulates himself and the country on the alleged success of his department in putting the postal business of the country on a self-supporting basis. The surplus for the last fiscal year was, he says, about $3,600,000; and there will be "no danger of recurring deficiencies." The fact that the railroads have been made to carry thousands of tons of parcels without compensation seems to be overlooked; yet Ralph Peters, chairman of the railways' committee, estimates that the loss to the railways this year, because of the not-paid-for parcel post, will be at least $8,000,000!

We shall not further comment at this time on what appears to be a childish, not to say frivolous, attitude, on the part of a high officer of the government. Judging by a number of editorial references already observed, Mr. Burleson's mistaken position is coming to be quite generally understood by the press throughout the country. Some of the editors—and they are not political opponents—almost laugh in his face. But the cure of the present mail-transportation abuse depends on a general knowledge of a good many facts and, pending the receipt of the full text of the forthcoming annual report, the reader will be interested in some grotesque incidents connected with the operation of the parcel post which may not receive detailed attention in the official publication.

Under the caption "Can This Be True?" Collier's Weekly reprinted in a recent issue the editorial note in the *Railway Age Gazette* of August 21, entitled, "Varied Parcel-Post Philanthropies," in which was related the means whereby the contractor on the star mail route between Holbrook, Ariz., and Snowflake shipped 10,000 lb. of barley from Mesa, Ariz., to Snowflake by parcel post, receiving for his portion of the haul $22 more than the total cost to him of the barley laid down at destination. The editor of Collier's pointedly remarked that "if this is true there's a good deal of explaining for some government officials to do."

This does not stand alone. A similar and even more flagrant case has come to our attention recently. The contractor carrying the mail on the star route from Holbrook, Ariz., to Hunt has arranged to purchase at Gallup, N. M., and ship to himself at the end of his route at Hunt 200,000 brick. These brick cost him $12 per thousand at Gallup, or a total of $2,400; the cost of packing for shipment by parcel post has been estimated at $600; the postage from Gallup to Hunt by parcel post is $1.08 per 100 lb. It is estimated that freight can be transported by team from Holbrook to Hunt for $0.50 per 100 lb., while the contractor receives $2.18 per 100 lb. for the transportation of the mail. By putting through this transaction the enterprising contractor could throw the brick away at the end of his route and still make a net profit of $4,800. This should surely produce some incentive for the establishment of a thriving business in the shipment of brick to Hunt. We are waiting with interest to see whether the contractor in question will be able to carry out his plan, in spite of the fact that the post office department has been notified of it.

That the parcel post may not be the boon that it is supposed

to be to the smaller communities is illustrated by the shipment by freight of three carloads of catalogs by one large Chicago mail order house to as many western towns, from which points these catalogs were distributed to the adjacent territories by parcel post. To avoid a delay in passenger trains of several hours in loading the catalogs, it was necessary in each instance for the railroad to set out a special baggage car in which this mail matter was loaded beforehand. The government, it will be recalled, has made the generous addition of five per cent to the mail compensation of the railroads because of the addition of the parcel post matter.

And this reminds us that while, in dealing with star route contractors, mail order houses, and so on, Uncle Sam is an amiable and charitable Dr. Jekyll; when he turns his face toward the railways he always becomes the villainous Mr. Hyde. For example, a steam road has operated two trains each way daily which carry the mail on a branch running from an important metropolis to a small town 25 miles distant. An electric line was built several years ago which gave hourly service between the same points. On application from the people of the smaller town, the post office department arranged for the establishment of mail service at frequent intervals on the electric line. At the time of the next quadrennial weighing the electric line was handling very much the larger part of the mail, and arrangements were made for paying for it accordingly. But an industrious clerk in the postal department discovered an old law stipulating that no "street car" should be paid more for hauling mail between any two points than was paid to a steam road between the same points. Thereupon, regardless of the difference between the amounts of mail handled by the two routes, the compensation of the electric line was cut down to the same amount as was being paid to the steam road. It has remained at this figure ever since, and no attempt has been made by the department to secure modification of the unjust law.

In another case, at the request of the post office department, a railroad consented to the establishment of closed pouch service on two mail routes running from a large city to two smaller towns, the two lines of the railway passing over common tracks to within seven miles of the termini. Upon the establishment of the parcel post the amount of matter handled increased far beyond the limits of the single closed pouch service, and the railroad refused to accept the parcel post matter. Relying upon the technical wording of the contract, the government then had pouches made of sufficient size to hold all the mail offered, including the parcel post, and forced the road to handle it at the old rate, although the amount of mail matter carried reduced the seating capacity of the cars for passengers. Furthermore, a clerk discovered that these two routes were operating over the same tracks for most of the distance and ordered that all this mail should be carried on one train to the common junction, in spite of the fact that the railway, in order to avoid stopping trains at this junction, would not permit passengers for either destination to board a train for the other terminal and change at the junction point. It is now not only necessary for the railroad to stop both trains at the junction, but to place a man there to transfer the mail. By this means the post office department saved 14 miles of closed pouch service, while the railroad was forced to stop its trains to handle this "local freight" traffic.

These illustrations are on a parity with the practice followed of shipping the empty mail sacks by freight until the close of the weighing periods, after which they are again turned over to the railroads for shipment in the regular mail cars. Uncle Sam is now trying to teach, and even compel, the business concerns of the country to be efficient and honest in their methods. But he seems to lack certain qualifications for the job. In his own business relations he is at times one of the biggest imbeciles and at times, where he has the upper hand, one of the most unscrupulous rascals, in the whole commercial world of North America.

EFFECTS OF THE PANAMA CANAL ON RAILWAY TRAFFIC

SOME startling statements showing the effect of the opening of the Panama Canal on the traffic of the transcontinental railways were placed before the Interstate Commerce Commission at the recent hearings in the intermountain rate case. More information of the same kind is coming out daily. If the commission grants the petition of the roads for such a modification of its fourth section orders as will permit them to reduce rates to the Pacific coast terminals on the commodities most subject to water competition without at the same time correspondingly reducing their rates to intermediate points, they will undoubtedly be able to retain some of the traffic. But this will be at the price of making very low rates; and they will lose a large amount of business on which they do not feel able to meet the competition. If the commission fails to grant the petition, and the roads are thereby forced to abandon the water competitive traffic entirely, or to make corresponding reductions in their intermediate rates, the results will be disastrous.

The effect of the canal competition on the roads is bound to be serious in any event—much more serious than railway men have expected. Within the past year or so, in anticipation of the opening of the canal, the water competition has been increasing by leaps and bounds, due partly to reductions in rates by the ocean carriers, which have had the effect of changing the sources of supply of many commodities from the Middle West to Atlantic seaboard territory, and partly to the growing disposition on the part of shippers to use the ocean service because of the recent change in the policy of the roads in failing to meet water competition. The opening of the canal, which occurred on August 15, has, of course, resulted in much better service by water than could be given by the steamship lines operating in connection with the isthmian routes. The time is shorter, the dates of sailing are more frequent, and the water lines are giving service from additional ports, principally South Atlantic and Gulf ports. Moreover, new steamship lines have established, or announced their intention of establishing service, and as a result both of this fact and of the reduction of cost of the water service caused by the opening of the canal route, there has been a very radical reduction in the rates of the water lines, which has attracted a large number of commodities formerly moving entirely by rail.

In September the total tonnage westbound from the Atlantic seaboard to Pacific coast ports via the canal was 77,915 tons, which if multiplied by 12 would be over twice the tonnage moving by water in any previous year since 1907. According to the Canal Record, from August 15 to October 15 the commercial vessels using the canal carried through it 583,949 tons of cargo, of which about 50 per cent was between the Atlantic and Pacific coasts of the United States, 24 vessels carrying 151,290 tons eastbound and 25 carrying 135,214 tons westbound on this route. Westbound manufactured goods of great variety and general merchandise have constituted the heaviest traffic, and eastbound the boats have carried chiefly canned fruits, vegetables and salmon, lumber, grain, sugar, pineapples and wine. Six lines are now engaged in the traffic through the canal, with an estimated monthly capacity of 111,600 tons, making the voyage from eastern ports to San Francisco in from 23 to 27 days. These lines are making rates from the seaboard not only far lower than those of the rail lines, but so low that freight is being carried eastward by rail from points as far west as Milwaukee and reshipped from the seaboard by water at a combination rate lower than the rail rate from the Middle West to the coast. As a result many commodities that were formerly shipped by rail from the Middle West are now being shipped from seaboard territory.

In a freight house of the American-Hawaiian Steamship Company at San Francisco recently were seen soap from Cincinnati, barbed wire from Allentown, Pa., canned goods from Milwaukee, and hardware from Wheeling, W. Va., all shipped by rail to the Atlantic seaboard, and thence by water to California. A boat sailing recently from Boston, which city formerly had no water service to the Pacific coast, carried nails, structural

iron and wire fencing from Pennsylvania, paper from Maine, automobile tires, ink, canned goods and boilers from Massachusetts, and electrical machinery from Schenectady, N. Y. Rails have been shipped from Lorain, Ohio; iron pipe from Wheeling, W. Va.; paper oyster pails from Chicago, and pipe and pig iron from Birmingham, Ala.

Rates far below those of the rail lines were announced on the opening of the Panama canal, and still greater reductions and low rates on a large number of additional commodities, were announced on October 1. In the case of pig iron from Birmingham the rate is 15 cents for the rail haul from Birmingham to New Orleans, plus 35 cents for the water haul from New Orleans to San Francisco, making a through rate of 50 cents against the all-rail rate of 65 cents. Paper bags have been shipped from San Hill, New York, at a rate of 55 cents, as against the former water rate of 65 cents and an all-rail rate of $1. Wrought iron pipe from Wheeling takes a rate of 16 cents to New York plus 30 cents from New York to San Francisco. Canned goods are shipped for 45 cents by water as against 75 cents by rail. Rates on iron and steel articles generally have been reduced to 30 cents compared with a rail rate of 80 cents or more. The rates mentioned have been applied on westbound shipments, which are involved in the case before the commission, but the increased activity of the ocean carriers has recently been particularly noticeable in connection with the eastbound business. Since January 1, the American-Hawaiian Steamship Company has taken from Puget Sound to Atlantic seaboard points 700,000 cases of canned salmon, and is now quoting a rate of 30 cents on this traffic as against a rail rate of 75 cents. In September the number of boats sailing from San Francisco for the east was trebled, one every second day. The American-Hawaiian Steamship Company alone operates 26 vessels, with a total capacity of 260,000 tons and with sailings every five days between New York and San Diego, Los Angeles harbor, San Francisco, Portland, Seattle and Tacoma, making the voyage from New York to San Francisco in 23 days. This company has announced its intention of making Gulf ports eastbound and Charleston, S. C., westbound.

Thus far the railroads have been obliged to let the water lines have the business, not being able to change their rates to the coast without at the same time reducing their intermediate rates. As a result both the railroads and the shippers of the Middle West have lost business to the boat lines and to the cities of the east and west coasts. Eventually, however, it seems likely that the Pacific coast ports will lose a great deal of business destined to Hawaii and the Orient, which will go direct via the canal instead of by rail through the ports.

The rates thus far announced by the water lines are far lower than they were expected to make. The American-Hawaiian Steamship Company has doubtless announced low rates at the start partly for the purpose of keeping other lines out of the service, and partly for the purpose of preventing the railroads from attempting to meet the competition. Moreover, the water lines, not being subject to regulation, are in a position to make whatever rates are necessary to get a cargo, quoting one rate today and another tomorrow without notice of change. When the American-Hawaiian Steamship Company has succeeded in killing off some of its new competitors it is likely to advance some of the rates. The railroads, however, are in a different situation. Not only must they give 30 days' notice of a change of rates, which change must be approved by the Interstate Commerce Commission, but at present they cannot reduce rates to the coast terminals to meet water competition without also reducing their rates to intermediate points not subject to such competition. Moreover, having reduced a rate to meet water competition they are prohibited by the act to regulate commerce from advancing the rate at a later time "unless after hearing by the Interstate Commerce Commission it shall be found that such proposed increase rests upon changed conditions other than the elimination of water competition."

Thus under our enlightened system of government regulation, designed to prevent discrimination, the people of the whole United States have built a canal which gives the Atlantic and Pacific coasts an advantage over the Middle West, and water lines an advantage over the railroads, and have also legislated to prevent either from meeting the competition. Railroad-owned boats are barred from the canal, and the roads are prohibited from making rates that will enable them to compete with the water lines without at the same time cutting rates not affected by the water; and if they do reduce rates to meet water competition they will have the greatest difficulty in raising them again.

The railroads formerly met water competition by whatever means they could by cutting rates, by giving rebates and by other devices—and after having put many of the boat lines out of business proceeded to advance their own rates. Now they object when the tables are turned. Regulation put a stop to their practices. They have been severely condemned for them and have been punished by all kinds of restrictive legislation. Perhaps they cannot object with much grace when the tables are turned. But there is manifestly a vast difference between unfair discrimination resulting from commercial competition and unfair discrimination caused by national legislation; and the latter is what we have now.

In the event of a refusal of the Interstate Commerce Commission to modify its order regarding transcontinental rates it would seem that the salvation of the railroads depends upon the exercise of restraint in meeting water competition. A possible decision on the part of some of the transcontinental lines to meet the ocean competition at Pacific coast terminal points in the face of such a refusal, with a consequent reduction of the intermediate rates also, would produce effects on the entire body of railway rates which would be fearful to contemplate. On the other hand, if the roads fail in their present effort to obtain a modification of the order, and stand firm and refuse to meet the competition under the conditions imposed as to terminal rates, an opportunity will be afforded for an actual demonstration of the unwisdom of the commission's order. Under such conditions there is reason to believe that the clamor from the Middle West would soon force the commission to grant a modification of its order just as the clamor from the intermountain shippers induced it to make its original order.

NEW BOOKS

The Western Blue Book and Buyer's Reference. Published by Allen Winch, 504 Sherman street, Chicago. 7 in. by 9 in., 592 pages, bound in cloth. Price $5.

This is a complete classified list of the constructional engineering, electrical, mechanical, mill, mining, foundry, iron, steel, quarry, machinery, railroad supply and kindred industries, arranged for the purpose of giving both buyers and sellers a ready reference to the names of companies engaged in these industries with their correct addresses and the names of the officers. The various industries are classified under a list of commodities, and also alphabetically under the names of the various classes of industries, subdivided geographically by states and cities.

Air Brake Catechism. By Robert H. Blackall. 406 pages, 4½ in. by 6½ in. 149 illustrations. Twenty-sixth edition. Bound in cloth. Published by the Norman W. Henley Publishing Company, 132 Nassau street, New York. Price $2.

This book needs no introduction to railway men. The fact that it is now in its twenty-sixth edition is evidence of the position it occupies among students of air brake operation. It is a complete treatise on the Westinghouse air brake, including the latest developments in steam railroad practice. In addition to descriptions of the apparatus and its operation, the book contains chapters on brake rigging calculations, air hose tests and train inspection and handling. The question and answer form previously used has been followed in the new edition and a number of full page colored plates are included.

Letters to the Editor

THE AMERICAN RAILWAY ASSOCIATION

TORONTO, Ont.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

The fall meeting of the American Railway Association held in Chicago, November 18, made a record for despatch and the operation of the "steam roller" in transacting its business.

The entire time occupied in disposing of its business was one hour and thirty minutes, during which ten committee reports were presented, many of them read, recommended for adoption by resolutions previously prepared, and offered in each case by a member of the committee presenting the report, voted upon by viva voce vote and passed. About one-half of the time was occupied in reading reports already printed and in the hands of members for several weeks previous to the meeting.

Article 2 of the Organization of the Association provides that "Its object is the discussion and recommendation of methods for the management and operation of American railways." The discussion of reports has been practically eliminated from its proceedings. A committee report presented with a resolution from one of the committees for adoption is equivalent to its being formally adopted by viva voce vote of those present, and the vote of a road having one membership in the association, and perhaps five representatives present, each of which may vote audibly, counts for more than that of a road having six memberships and only one member present.

The association has resolved itself into a close corporation with the object of discouraging discussion and accepting the reports and judgment of a committee as final on a particular subject, making in effect a minority rule, and in the final analysis one man's opinion is paramount to that of the members attending a meeting, as it is well known that in committee work a chairman does most of the work and his opinions are reflected in its conclusions, the rest usually concurring.

Ten to fifteen years ago the association usually occupied two days in its sessions and they were full of active interest and discussion, and it was worth while to attend its meetings for the benefit derived from the discussions alone. As now conducted it is a waste of time for some members to travel perhaps a thousand miles to simply hear reports read and formally rushed through by a vote which does not represent the association's membership by one-half. It would be an improvement to dispense with the meetings entirely and submit all reports to letter ballot, which at least would give every road an opportunity to vote in accordance with its privilege under the articles of organization.

The present practice of distributing memberships on various committees is not equitable. Many roads, large systems with as many as six and eight memberships, are not represented on any committees, and have absolutely no voice in the association's affairs, while small roads, in some cases less than one hundred miles in length, are represented on several committees.

Analyzing the personnel of committees according to the last report, it is found that one railway system has representation on each of fifteen committees, and on two of these two members in each. Another system has representation on seven committees, another representation on six committees. Again, large systems with eight and six memberships have no representation on any committees, and according to the present practice of rule by committees they have no voice in the association's affairs.

The perpetuation of some roads on a committee by re-election is also unfair to other roads, which are never given even a nomination for committee membership. It should be a rule, strictly observed, that no road shall have representation on more than one committee concurrently, and when the term expires shall not be renominated on the same committee without an interval of two years.

Chairmen of committees are also perpetuated to such an extent that the same routine in some cases goes on from year to year. An inactive chairman greatly retards the work of a committee, and by making senior members chairmen they automatically give place to successors who may have new ideas on the subject.

The principle of equitable distribution of opportunity to have a voice in the affairs of the association should be consistent with the policy of equal distribution of the cost of conducting its affairs, which is by membership and on a mileage basis, but this equality is now not observed.

The whole scheme of railway associations as now constituted represents a lamentable waste of time and money. There is a duplication of work and lack of co-ordination which should be corrected.

There should be one railway association governing operating matters and including transportation, maintenance of way and maintenance of equipment, instead of five associations covering the same ground, as at present, with numerous offshoots of these which could all be embodied in one organization with better results and a great saving of time and money to the railways, which in the end pay the bills. The expense of conducting the American Railway Association is over $100,000 per annum, and of the other associations combined about as much again, and adding to this the expense accounts and loss of time incident to attending the association meetings the cost to the railways is about $500,000 yearly.

It is time to consider seriously if we are getting value received and the best results from the expenditures on account of our railway associations, and whether the principles upon which they are conducted are correct. L. C. FRITCH,

Assistant to President, Canadian Northern Railway.

THE TRAINMASTER AND THE ENGINE HOUSE

NEW YORK.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

The editorial on this subject in the issue of September 25, is, of course, only a further plea for co-operation, and it might not do any harm to go a little further and point out how this could be secured between the engine house and the trainmaster.

In far too many cases the "pull, push and jerk" policy followed by engine house foreman, trainmaster and despatchers, is not given proper notice by the man higher up; it should receive his most earnest attention. We all know that it is not always easy for him to determine just which one is most to blame, but a good plan to follow, after he has had a certain number of complaints and cannot find that the fault is all on one side, is to eliminate both sides and start new men, with the understanding that when they cannot agree among themselves, they cannot agree with him.

In a plan of team work that I have seen worked out to good advantage, the engine house foreman laid down the rule that his engine house was to be run on the plan of a fire station; that it had its regular daily and nightly duties to perform, and in addition, must respond promptly to all extra calls, so far as equipment on hand permitted. When time card trains had been provided for, the foreman placed in the hands of the trainmaster each morning, a list of his remaining engines. This list showed so many engines available at once, giving the numbers and class; so many under light repairs available, in a certain number of hours; and the remainder as nearly as he could estimate. The trainmaster then knew how many trains he could send out, and could make up his trains to suit the power available. There is nothing very remarkable in all this; but when so many are working on no plan at all, it may be worth while to point it out. STOREKEEPER.

Railway Troubles Due to Lack of Public Understanding*

Importance of Railway Service to the People Demands Intimacy of Understanding and Mutual Confidence

By W. G. Harding†

Perhaps our "hot or cold" affections for our transportation lines are due to inherent traits in human nature. We are seemingly eager to seek that which we have not and find excessive fault with that which we possess. The enthusiasm over our railway acquirement ebbed when transportation gave us an era of development unmatched in all the progress of mankind. No sooner was the triumph recorded than sentiment veered, and hostility to railroads became a gospel of wide popularity. But popular sentiment eventually gets right, and I can say tonight that the intelligent public thought of this land of ours is demanding just treatment of the American railroads.

EFFICIENCY OF RAILROADS ESSENTIAL TO NATIONAL PROSPERITY

Amid all the clamor and appeal, two thoughts are indisputably established—the efficiency of American railways is absolutely essential to American agricultural, mining and manufacturing industries, which are the component parts of our boasted commerce; and the good fortunes of the American railways and the American people are indissolubly linked together. The present distress of our industrial and commercial interests, happily showing some signs of relief, has its reflex in the distress of our railroads, or if you prefer it differently expressed, the distress of our American railroads is very evident in the halted condition of business throughout the land. This is not to say that the ebb-tide of American good fortune is wholly due to the distressed conditions of our railroads, but the fortunes of the transportation lines and our people are so indissolubly linked together that the one cannot be injuriously affected without finding its reflex in the other.

The argument never has strongly appealed to me that we ought to prosper our railroads for the specific purpose of promoting general prosperity. It seems to me more important to prosper our transportation lines as a simple matter of fairness and justice to this important single agency in our modern lives. The popular mind has been slow to grasp the surpassing importance of railway transportation. Ten thousand captains of industry, notably in the interior, have realized that railway facilities made their enterprises possible and profitable, but the toiler in the ranks has taken it all as a matter of course. The interior farmer, far from water routes, has seen the market brought to his door, almost, and has been a beneficiary of the elevation of farming from a mere struggle for subsistence to a conquest for accomplishment, but has been unmindful of the contributing agency which did so much to open the way.

I can recall full well how the railway extensions were heralded with glad acclaim, and I have heard, since then, the inevitable reverse which comes in the loud complaint of those who quickly forget the agency which made possible the astonishing shift from wilderness to the glorious garden, where sunshine is shaped into profitable products of commerce.

THE RAILROADS NOT BLAMELESS

This reversal of popular sentiment toward railroads in general is not wholly without reason. There had been profligacy of management, excessive profits in promotion, piracy in financing, along with unrighteous discrimination and contempt for popular opinion, more or less heralded in the press. These were seized upon by politicians, more eager to profit in the proclamation thereof than to correct the abuse, until there was good reason for popular suspicion and unrest. Hateful as these things are in public estimate, there was some extenuation. Many a railway was constructed for the profit in promotion, else it had never been projected. In this fact lies the explanation of much of our development. Builders were not content to wait for the profits of carrying, because the awakened production and carrying thereof had to come of too slow a process. It is fair to say, however, that in most cases the fictitious values have become very real in the processes of attending growth. The piracy of high financing—watered stock and excessive bonding—is not to be so readily excused, and is, in fact, mainly responsible for the hostile frame of the public mind. Much of the predatory plundering attended the evolution of lines into systems, an accomplishment which none of us would undo, because the advent of systems marked a higher stage of capacity for public service, and our people must not let their righteous hostility to this plundering blind them to the progress made. Hateful as it was, it nevertheless was a practice of the period, partly to deserve our tolerance because of improved capacity for service.

One thing is certain, though our people cry out against the great predatory captains who dashed by in their special cars, the lumbering trains of honest investment have traversed the same rails, and the honest endeavor and best thought and best energies of American life have reared this American railway giant and furnished us the best and cheapest rail transportation in the world. There must be—there is—a righteous mean between plundering on the one hand, and popular assault on the other, and the problem of the day is to find that righteous mean and give to our railroads our boasted square deal.

I believe, in all sincerity, that the day of plundering financing has passed. I should like to proclaim, in the same breath, the passing of railroad baiting on the part of press and politicians, who have been less inspired by public good than by personal profits and political gain. It has been a great stunt to hammer the railroads.

AN EXCESS OF COMMISSIONING

Fortunately the drift is toward the sober second thought, and there is a realization that these vital factors in making for profitable production and general good fortune are entitled to just treatment. There is the conviction that when governmental regulation leads to paralysis, we require less of it—that is to say, less of doctoring in order to give the patient a chance. It cannot be disputed—there has been an excess of commissioning, and our people have not stopped to count the public cost of the practice, nor to measure its hampering influence. Do not mistake my meaning. I believe, most heartily, in the government regulation of public utilities, but it must be righteous and understanding regulation. The best railway knowledge in all the land ought to light the way. Public service ought to be the impelling purpose, unheeding of public clamor. There can be a species of excessive regulation which will lead to but one logical result—and that is government ownership. It is the logical outcome of the present drift, it is the only remedy if we are to require a service at rates inadequate to meet fixed charges and provide means for maintenance and needed improvements. The answer to this statement is readily anticipated. Ten thousand tongues are ready to cry out about over-capitalization in stocks and bonds. It is true, in the main, but the over-capitalization comes of a previous era. It comes of the evolution into systems, and the crime of over-issue does not justify the wreck of the surpassing structure of American railroading.

*Abstract of an address which was made at the annual meeting of the Railway Business Association, Waldorf-Astoria, New York City, December 10, 1914.

†Mr. Harding has been editor of the Marion (Ohio) Star for the past thirty years. He has served as state senator and lieutenant-governor of Ohio and made the nominating speech for Mr. Taft at the 1912 republican convention in Chicago. He has just been elected United States senator.

Our problem is not of yesterday, it is of today and the morrow. It is up to fair-minded American intelligence to deal with the rail transportation problem as it exists today, recognizing that increased cost in transportation is quite as natural as increased cost in labor and taxes. Transportation cannot be eliminated from the cost of a single article of commerce in the complexity of our modern life, nor escape the upward trend of cost.

THE WISDOM OF JOSEPH

I believe it is the opinion of ninety-nine of every hundred thinking people that the railways of the country are entitled to an increase of rates, and would gladly see it granted. The thinking citizen not only desires that the railroads shall be able to exist in dull times, and earn money to meet their obligations; they are also entitled to earn a profit in fortunate years which may be turned to betterments when the lull comes.

The wisdom of Joseph holds good to this day, and my application of the story to American railways is that they ought to be able to earn enough in the fat years to be prepared to carry on their vast improvements in the lean years which inevitably come. Under our present system of reduced and insufficient earnings, along with increased cost of operation, there are no marked railway betterments except in the high tide of earnings, when cost is highest and improvements are hampered by traffic operations. We ought to reverse this order, and provide ample revenue in good times to enable extensive betterment to be made in the dull period, all of which would tend to better service in the days of the revival, and, meanwhile, the expenditure for betterments would relieve the general dullness amid such conditions as we complain of today.

PHYSICAL VALUATION A COLOSSAL FOLLY

This thought grows upon me when I am reminded that billions are said to be required to be expended to bring our railroads up to the facility for efficient service which managers themselves believe to be the due of our people. I have heard railway men say that they gladly would be making expenditures now, but they cannot borrow and do not earn sufficiently. Through agitation and restriction there has come impaired credit, until there is a threatened collapse of the railroad edifice, and it's up to American fairness to make the restoration and provide for maintained eminence. These items of maintenance and betterments have been overlooked by the political exhorters who have baited the railroads to catch unthinking popular favor. The advance from the dinkey wood-burner, which I helped to wood-up as a boy, willingly, while Dad's wood-pile needed attention, to the great locomotive of today, with heavier rails, and the thousand conceits of modern genius, which add to safety and enhance the service, has involved renewal costs beyond all comprehension. When we come to a physical valuation, if we must commit that colossal and costly folly, I wonder where the genius will be found who can apply apt figures to cost and worth of experience and evolution. The agitating politician makes no new investment and knows nothing about cost, but continues to blow with the same old blather.

WE DO NOT WANT GOVERNMENT OWNERSHIP

This railway problem is so big and so important that I feel the inadequacy of my words to portray it. We do not want government ownership, though that is the logical drift. I am opposed to it because it is contrary to the spirit of our institutions and violates the very conception of the rights and duties of government and citizenship which has given us an individual accomplishment which the world can nowhere match. It would stifle our further development and take from individuals the impelling purpose to accomplish and achieve. We might as well adopt paralyzing socialism, and fling aside, once and for all, the surpassing American accomplishment which has been the pride of our own people and the admiration of the world.

Does any one believe that government ownership would have pushed the railway along the sands, and connected up the Florida Keys with arched concrete and bands of steel, which clipped twenty-four hours from the commercial time between Cuba and the United States, and set fairyland abloom for three hundred miles en route? Does any one believe that federal ownership would have threaded the plains and pierced the Rockies as individual enterprise has opened the way from coast to coast, and touched the desert as well as the valley and mine with man's developing hand?

I shall be fearful of government ownership until France and Germany have given real proof of government efficiency and economy in railway management, and our own government has given some assurance that it may carry on any business with the economy which characterizes every well-managed, individual enterprise. Nay, more, I shall doubt all plans of government control until we have acceptable proof that the government can fairly regulate through its commissions, when real railroad men are making the tremendous struggle to conserve their properties and serve the public with these vastly important agencies.

Perhaps the lack of successful regulation is due to the newness of the undertaking, to the unavoidable political agitation and to the harassment of conflicting authority because of varied state legislation and state commissions. Our American railroad enterprises are so vast that it has seemed to me that none is longer small enough to be encompassed by intra-state lines, and we ought to put the entire service under inter-state control. Such a policy would save millions in public expense and put us on a broad plane which is befitting the gigantic character of American railway operation. We should then escape the excess of state legislation. I speak deliberately—the law-making industry is too often worked overtime. This country needs today less legislative bills pending and more railroad bills of lading.

RATE INCREASE NECESSARY

It is apparent that the Interstate Commerce Commission believes in the pressing necessity for increased earnings for our railroads. The suggestions of increased passenger rates, baggage charges and other collections for service not charged for heretofore, indicate the controlling body favors increased earnings, but opposes the short and direct route. The rate increase would be direct and immediate, and these other remedial efforts could be left to follow by the slower process of evolved adoption. If the combined income from increased rates and added service charges made excessive earnings, contrary to public policy, the same authority which grants the increase could order a reduction.

The simple public mind, unbiased in the matter, thinking only of fairness and the common good, favors the increase and does not expect a later reduction. We have seen the advance of wages. We know of mounting taxes. We can understand all about more costly equipment. Having come to pay more for our food, we only wonder that we have not been charged more for its transportation. Knowing the increased cost of operation in every other industrial and commercial enterprise, we have wondered how any one could escape added cost in the chief agency of exchange and distribution.

Our American wage scale is twice to thrice that of Europe. Our rates of interest are generally higher. Our distances are greater and our population less dense. Under all these conditions it would be very natural for our railway transportation to be higher. Our freight rates are notably less, and our passenger service only a trifle higher, and it is vastly superior. When classification is taken into account I believe ours is the cheaper. And yet on this very branch of business which costs the more in this country, the railway commission recommends the increase which it is powerless to grant. If argument were needed for the general advance, the commission has presented it. I hope it will speedily come. It will not bring the complete revival of American activity, but it will not only save the crash of the temple of transportation, but will re-establish railway credit, and lead to that physical rehabilitation which is of prime importance in ministering to greater American activities. More, and very

significant, too, the governmental assistance in the hour of need will be new assurance that it is neither the function nor the purpose of government to destroy, but to foster and protect, and American business success, lawfully achieved, is to be encouraged and heralded as important to American progress.

Perhaps a considerable part of political play in hostility to our railroads is due to the mistaken impression that they are the property of a few of the enormously rich. If this were true it would not alter the demand for just treatment, for the civilization which ignores property rights will quickly trespass human rights. As a matter of fact, however, our railroads are largely the property of those we term the people, and their securities are in the assets of savings banks, life insurance companies, hospital and college funds, and the foundation of thousands of sacred trusts. The directing heads of these lines and systems are not the scions of wealth, nor the creatures of privilege, they are the finest examples of the reward of merit which we have developed in the boasted opportunities of American life. When the moneyless American youth may climb from the humblest rank of railroading to the direction of the energies of hundreds of millions of capital and many thousands of men, through sheer force of ability and conscientious service, the system cannot be far wrong. It is our inspiration to developing youth and assurance doubly sure that ours is the civilization of opportunity. In every city throughout the land is some allied industry, and at the head of these are the worthy captains of American endeavor, who have grown up from village or farm, and toiling with them, when the tide runs full, is a thrifty, well-compensated, prospering people, rejoicing in American triumphs and eager to go on.

There are two things to commend to the public, to railway managers and to members of the Railway Business Association. One is simple honesty, the other is greater intimacy—the fullness of understanding—between the railway management and the public served. There has been too much aloofness, sometimes a contempt for public regard. The minds which lead in making dependable public opinion mean to be fair, and need only to be informed. Railways have suffered needlessly because of the lack of public understanding. The public has an ear for the manager, as well as for railway baiters, and the growth of favorable public opinion today is traceable to the fact that railways have laid their case before the public. The importance of railway service to the people, the public character of the business, and public regulation, all demand intimacy of understanding and mutual confidence. Add to this the unalterable honesty that is essential to right management and the abiding honesty that makes for sincerity in politics, and we shall hail a new era, which shall mark a greater and swifter stride to our American astonishment of all the world.

THE TRAIN DESPATCHER'S OFFICE

[E. T. Mulquin, in Train Despatchers' Bulletin]

Generally speaking there is a lack of painstaking effort exercised as to location and office equipment for the train despatcher, to aid him in reaching and maintaining the highest standard of efficiency. How often do we see the despatcher's office consolidated with the telegraph office with its boiler-shop noises and with persons continually running in and out. This disturbs the despatcher, as he will unconsciously take some notice of what is going on about him.

Where the telephone is used for train despatching and at offices where more than one set of despatchers are employed they are frequently located too close together; often one table being equipped for two men. The conversation of one despatcher on the 'phone is annoying to the other. If the chief despatcher is also quartered in the same office, this adds to the confusion, as he has many callers.

The train despatcher's office should be as private as possible and separate from the chief despatcher's office. Each despatcher should have an individual table, and where the telephone is used the tables should be far enough apart to prevent the talk of one despatcher from attracting the attention of the others. The tables should be constructed on commodious lines. . . .

RAILWAY AFFAIRS IN OTHER COUNTRIES

A recent issue of the Railway Gazette of London contains the following editorial comment: Not the least important undertaking whose future will be profoundly modified by the outcome of the war is the Bagdad Railway. Being wise after the event is easy enough, but it is somewhat difficult today to understand the lack of diplomatic prescience which gave Germany the control of this railway. Knowing what we now do of the comprehensiveness and foresight which have characterized the German plans, it does not require much imagination to assume that a country which counted on inducing Turkey to take the field must have realized to the fullest extent the military potentialities of the Bagdad Railway. Indeed, it is today rather surprising that any financial considerations should have been allowed to stand in the way of pushing on the line as rapidly as possible. The real objective of the Bagdad Railway is the Persian Gulf. In the light of present events it is amusing, or it would be amusing if it were not so serious, to reflect that a short time ago public opinion in this country was quite satisfied by the projected arrangement to place the terminal section of the line under international control, with Turkey and Germany among the controllers. History seems likely to repeat itself, and just as the fruits of German enterprise and expenditure in Kiao-Chau and her African and Australasian colonies will be reaped by other powers, so in the final adjustment the intrigues and the expenditure on the Bagdad Railway will not result in any gain to Germany.

* * *

The Railway Gazette of London, which has recently compiled the latest available figures regarding the number of employees of the British railways who have left their work to join the army or navy since the beginning of the war, estimates that the total at the end of September was 56,874. Most of the British railways have adopted the suggestions of the railway executive committee, which has had charge of the railways for the government since the beginning of the war. Each company is making an allowance to the wives and families which, supplemented by separation allowances and an amount deducted from the army pay in accordance with the government regulations, is equivalent to not less than four-fifths of the individual's pay when he was in the company's service. Allowances are also made to the dependent relatives of unmarried men and widows without children according to individual needs. The companies are paying their employees' contributions to superannuation and other funds during the men's absence and will endeavor to restore to them their former or equivalent positions if they are physically fit. As far as possible, also, work will be found for such as have been incapacitated. The figures as compiled for some of the larger companies are shown below. The numbers have probably not increased greatly since the end of September, because to prevent the railways from becoming crippled, instructions were issued by the war office that no one in the railway service was to enlist without the permission of the head of his department. For the purpose of comparison there is also shown the total number of adult male employees of each company on December 31 last:

	Enlistments	Adult male employees Dec. 31, 1913
Caledonian	1,600	21,477
Great Central	2,700	29,460
Great Eastern	3,000	30,512
Great Northern	2,500	31,352
Great Western	8,019	72,454
Lancashire & Yorkshire	3,608	36,525
London & North Western	9,528	79,348
London & South Western	2,100	22,614
London, Brighton & South Coast	1,510	14,477
Midland	6,700	66,340
North British	2,000	23,243
North Eastern	5,400	52,984
South Eastern & Chatham	1,702	21,224
Underground Railways of London	931	6,232

THE HANDLING OF LOCAL OR WAY-FREIGHT TRAINS

By R. R. FARMER

Trainmaster, M. K. & T., Parsons, Kansas

The local or wayfreight is a train of necessity, but in many instances it is a forced expense. In some places locals have to be run to handle local C. L. and L. C. L. business that does not actually pay the cost of the operation of the train, due to certain parts of the district originating no business and the other parts originating more business than the local can take care of. As a result the local on that part of the division where no business is originated will earn nothing by handling its full tonnage to the intermediate or local terminal, as the local on the other part of the division where a large volume of business is originated cannot handle it on account of the local business making full tonnage for it. In such cases it is necessary to run through trains light out of terminals and across part of the division to handle the tonnage that the local has handled to such point, therefore nothing has been gained by running such local and its only real earnings are from the local business handled between its terminals.

In many instances locals are run when their cost of operation tends to decrease greatly the profits or earnings, caused principally by inefficient crews, poor facilities, tracks and facilities located without regard to economical operation (caused by leases made to industries with only the view of leasing the ground and securing the location of the industry on the railway's tracks), indifferent and inefficient station forces, and poor power. Any or all of these cause delays which run into overtime which costs from 28 to 35 cents for each 10 minutes according to the number of men in the crew.

The most important factor in wayfreight operation is the conductor. This man, when big enough for the position, will perform miracles on a heavy overtime local. He will organize his crew, selecting the most efficient and intelligent brakemen, who are not afraid of work and who work regularly, judging them by their disposition, honesty, quickness, sobriety and reliability. In a few weeks he will line up the station forces by his cheerful disposition and ability, by his willing and obliging nature and his efforts to get his work done and get over the road. He will employ a method of making accurate records of all cars, seals, OS&D merchandise, delayed cars and other irregularities. He will not set out a good, clean car fit for grain or flour loading, if a car is wanted to load empty oil barrels or fertilizer, when by making a short switch he can set out an old car suitable for the purpose wanted. He will transfer freight to release cars and will consolidate all L. C. L. freight that he can, taking as small a number of merchandise cars as possible into the terminal, which will obviate the necessity of taking up all the room at the transfer platform for his train. He will not set out an empty box car for wood loading when he has an empty stock car that is not in demand at the time. He will keep posted on the movement of all classes of equipment and will keep in touch with the maximum and the average capacity of all industries and mines on his division.

To successfully fill the position, a local conductor should be accommodating and courteous to all. He should not be too old nor too young, but his age should be sufficient to give him mature judgment and discernment. He should have had experience as a brakeman on all kinds of freight trains. He should have a good common education, be familiar with waybills, and posted to some extent on tariff matters such as the minimum carload weights on various commodities in order that he will know that a shipper cannot load the minimum weight of hay in a 30 ft. car and that by filling such orders with small cars he will only delay the car, annoy the shipper and cause additional work picking up the small car and setting out a car large enough to get the minimum weight in. He should also be posted on demurrage and per diem rules.

My observation has been that a great many locals are held by rights of seniority and not by qualifications of the men operating them. I have seen men running locals who were good enough for through freights but entirely impossible as local conductors. They will drag over the division earning three to four hours overtime daily and increasing the cost of operation from $150 to $250 per month. They have no initiative and no interest in their work, they are sore-headed and their crews are disloyal, feeling that they would rather see them laying off than at work. They do not figure on their work until they arrive at the point where it is to be done. Every one they come in contact with meets them only because it is necessary to transact business with them. They take a technical advantage of all instructions whenever possible to make it to their advantage. Their records are only such as the rules force them to keep. They simply hold their runs by seniority rights given them by agreements and will cry "Discrimination" at every effort to dislodge them from the runs.

In my opinion the local conductor should be picked from the ranks for his qualifications as a local conductor, as an assistant to the chief despatcher and a lieutenant to the trainmaster. He must be a man who can handle men and yards, as he is a traveling yardmaster over the part of the division to which he is assigned. He is the agent at all non-agency stations. He should represent the policy of the company in politeness and courtesy to all patrons he comes in contact with, and what representative of the railroad comes in contact with as many big shippers in a day as a local conductor on a heavy division?

In the make-up of wayfreights it is preferable that the merchandise cars be placed on the rear end and the short loads on the head end, when conditions will permit, in order that the merchandise cars can be placed to work while the loads on the head end are set out or other loads picked up. However, this feature depends on the physical characteristics of the division and the location of the various stations. Each local caboose should be equipped with pinch bars and two pairs of rollers to facilitate the handling of heavy freight that may be shipped L. C. L. All local engines should be equipped with foot boards on the rear of the tenders and a 3-in. nipple and hose attachment on the rear of the tanks for the purpose of filling water barrels at stations, cotton platforms and wooden trestles, especially during the hot, dry weather. Wayfreight engines should also be equipped with straight air to facilitate and expedite the switching. The tonnage rating should be light enough for the power assigned to handle with ease over the ruling grades and to make a fair speed between stations.

A local division should be established on the basis of a ten-hour work day controlled by the business to be handled. The hours should be from 7 o'clock in the morning until 5 o'clock in the evening, as any time of arrival at terminals after 6 o'clock in the evening is not conducive to good service. The men figure that if they arrive at the terminal after 6 o'clock they cannot get their meals in time to spend the evening out and as a consequence they lag. When an arrival time from 5 to 6 o'clock will enable them to get their meals and allow them to spend the evening as they please, the earlier hour of arrival is an incentive all day to do their work as expeditiously as possible in order to arrive at the terminal on time.

Station forces should be on hand ready to break the seals, make records of same, and unload the freight as soon as the cars are placed. Switch lists of cars to be picked up or placed should be made out and a copy of same kept in the station records. All freight should be checked out of the cars by the agent or his representative. All over, short or damaged freight should be so noted on waybills and the conductor should sign each waybill under such notations. These matters are of little trouble but will save time, trouble and money to the company. It will enable the freight claim department to handle all OS&D claims expeditiously. All freight loaded at small way-stations should be checked into the car by the conductor, the same as the freight is checked out of the cars by the agent or his representative.

TRAIN CREW REGULATIONS IN CONNECTICUT

The Public Utilities Commission of Connecticut, acting under a law passed in 1913, has investigated the question of the adequacy of train crews, as managed by the railroads of Connecticut, and has issued a code of regulations for passenger trains. The investigation was ordered by the Legislature, as an alternative to passing a full crew law which was demanded by the trainmen's brotherhood. No order is issued in regard to freight trains, the commission holding that freight trains are already properly manned.

The commissioners have studied the subject for a year and have examined the records of 589 passenger trains of the New York, New Haven & Hartford, and in addition to this they have made personal observation and inquiry on 47 important trains, including those which had been mentioned in complaints. Members of train crews were carefully questioned.

There was already in existence a rule, issued by the former railroad commission 18 years ago, regulating the number of brakemen on passenger trains, and this is not much modified; it is deemed in the main reasonable. To increase crews beyond a reasonably safe requirement "would lessen efficiency by dividing responsibility." No instance has been disclosed where the safety either of the public or the employees has been jeopardized by an insufficient number of men in the crew. The railroads are vitally interested in the successful and safe movement of freight trains and should have some discretion as to the number of trainmen to be employed, unless it shall be made to appear that the safety of employees or the public is endangered and that freight commerce is unnecessarily delayed by reason of the lack of an adequate crew. This opinion in regard to freight trains is a confirmation of the opinion of the railroad commissioners, uttered in a report issued in 1911.

In the matter of the safety of passenger trains, the commission recognizes that a parlor car porter, a baggage man or a train porter can be made available in cases of emergency, and evidently holds that these men should be so availed of. "It is not always practicable in any line of business of considerable magnitude to maintain a sufficient force to meet all possible emergencies, and in emergencies all loyal and faithful employees have a moral duty to do extra work, where practicable, to save life or protect property."

The only hint of any criticism of the railroads of the state that is to be found in the report is a paragraph to the effect that "all well-managed railroads should anticipate with a reasonable degree of accuracy the needs of the service" on holidays and other special occasions.

In conclusion the commission holds that safety would not be increased by any general order for an increase of the number of men in crews, and proceeds to formulate its requirements in substance as follows (all referring to passenger trains):

1. Trains of two cars, at least one brakeman, who may be a baggageman.

2. Trains of three or four cars, exclusive of parlor, dining, sleeping, baggage, mail or express cars, two brakemen, one of whom may be baggageman, assistant conductor or ticket collector.

3. Trains of five to eight cars, exclusive of parlor, etc., three brakemen, which three may include an assistant conductor or ticket collector.

4. Nine or more cars, exclusive of parlor, etc., at least four brakemen, one of whom may be assistant conductor or ticket collector.

5. Trains composed entirely of parlor, dining, sleeping, baggage, mail or [and] express cars, at least two brakemen, one of whom may be a baggageman.

A combination baggage and smoking car is to count as a passenger car; a club, official, or private car is to be considered a parlor car.

The order is not to apply to cases of emergency, due to circumstances which may not be foreseen.

SUPPLEMENTARY ORDER IN THE FIVE PER CENT CASE

The Interstate Commerce Commission has issued an order under date of November 28 making such modifications in its findings in the Five Per Cent case (31 I. C. C., 351), published in the *Railway Age Gazette* of August 7, page 235, as will permit the carriers to establish increased joint through rates between points in central freight association territory and southwestern territory, and between many points in central freight association territory and southeastern territory. An abstract of the commission's order follows, the language of the commission being preserved in so far as possible:

In accordance with the report of the Five Per Cent Case, the carriers have filed increased intra-territorial rates in central freight association territory. Since rates between points in that territory and points west and northwest thereof, along the Missouri river, in Colorado and Utah, are generally combinations of intermediate local or proportional rates to and from the Mississippi river crossings, these increased intra-territorial rates in central freight association territory now apply between points west of the Mississippi river and points in central freight association territory. The increased intra-territorial rates likewise apply between points in central freight association territory and points in southeastern territory upon which joint through rates are not published, and upon which the central freight association territory lines receive their separately-established local or proportional rates to or from Ohio river crossings.

On the other hand traffic between points in central freight association territory and southwestern territory, and between many points in central freight association territory and southeastern territory moves under joint through rates, inceases in which were cancelled by the order entered in the Five Per Cent case. Many of these tariffs naming joint rates between central freight association and southeastern territory frequently specify the separate factors of said rates which accrue respectively to the lines north and south of the Ohio river.

In the opinion of the commission it now appears that the above mentioned order should be so modified as to permit the establishment of joint through rates between the points aforesaid which shall be sufficiently increased over the existing joint through rates to allow the central freight association lines an increase of 5 per cent in their divisions.

It is therefore ordered that respondents be authorized to make effective on not less than five days' notice joint through rates between points in central freight association territory and points in western, southwestern and southeastern territories, which shall be in excess of the existing joint through rates only to the extent that may be necessary to allow the lines in central freight association territory an increase not in excess of 5 per cent above the divisions which these lines have heretofore received. In cases where the tariffs containing said joint rates state separately the factors thereof applicable north of the Ohio river and east of the Mississippi river, the new tariffs published under authority of this order shall state separately the increased factors accruing to the central freight association lines; under the authority hereby granted, however, no increased rates shall be established upon commodities as to which increased rates were not authorized by the commission in its report; and where the relationship between through and intermediate rates would be altered by the permission incorporated in this order involving a departure from the strict requirements of the fourth section, the carriers must first file applications for relief under that section.

Fan Drafting as Applied to Locomotives*

Loss Due to Back Pressure With Existing Type of Front End Arrangement; Results of Tests Made With Fans

By H. B. MacFarland

Engineer of Tests, Atchison, Topeka & Santa Fe, Chicago, Ill.

The method of drafting a locomotive with its exhaust steam has varied in detail only during the long period of development of the steam locomotive. The basic principle is exactly that of 50 or 60 years ago. The exhaust from the engine was early utilized to produce the necessary draft and is commonly so used today.

The magnitude of the loss due to back pressure as it existed in representative locomotives on the Atchison, Topeka & Santa Fe was shown in a paper presented by the writer at the fourth annual conventon of the International Railway Fuel Association† in May, 1912. The material was collected from a large number of locomotives in actual service operating under greatly varying conditions and showed conditions existing at that time. A general statement is drawn based on tests conducted on 18 different locomotives representing as many different types, working under such varied conditions as are encountered upon the Santa Fe system, with territory extending from Chicago to the Pacific Coast, and presenting at one place or another most of the conditions encountered in railway service. This statement shows that for every 100 horsepower used as actual tractive effort, there are 66 horsepower wasted through the exhaust, over 70 per cent of which may be credited to the excessive back pressure necessary to produce draft for the locomotive boiler. A study of the facts has led the writer to the consideration of a more economical method of drafting locomotive boilers.

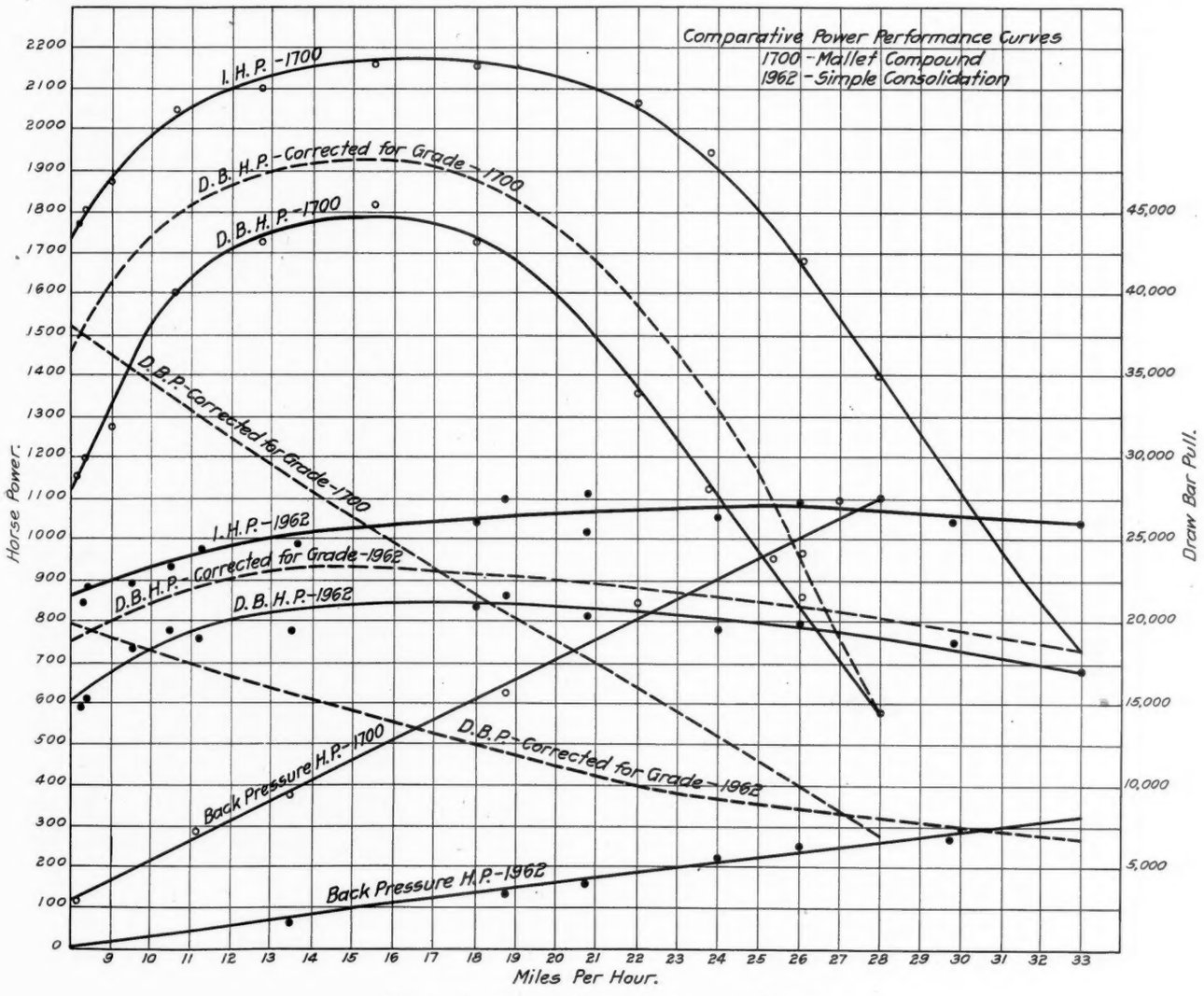


Fig. 1—Comparative Power Performance Curves

Comparative power performance curves for locomotives 1,700 and 1,962 are shown by Fig. 1. These curves were plotted as a result of data obtained during comparative tests on these locomotives on the third district, Arizona division, between Barstow and Bakersfield, Cal., a distance of 140 miles, in the winter of 1909. Locomotive 1,700, a Mallet compound (2-8-8-2), fitted with a Jacobs-Shupert firebox, Buck-Jacobs superheater,

*From a discussion of a report on Steam Locomotives of Today, at the Railroad Session of the annual meeting of the American Society of Mechanical Engineers, New York, December 2, 1914.

†See *American Engineer*, June, 1912, page 300.

and feed-water heater, cylinders 26 in. and 38 in. by 34 in., had a tractive effort of 108,000 lb. Locomotive 1,962 was of the simple consolidation (2-8-0) type, fitted with Baldwin superheater, cylinders 24 in. by 32 in., and had a tractive effort of 49,500 lb. These curves are presented because they show the enormous back pressure horsepower loss which is an inherent defect in the Mallet type locomotive. The curves show that the

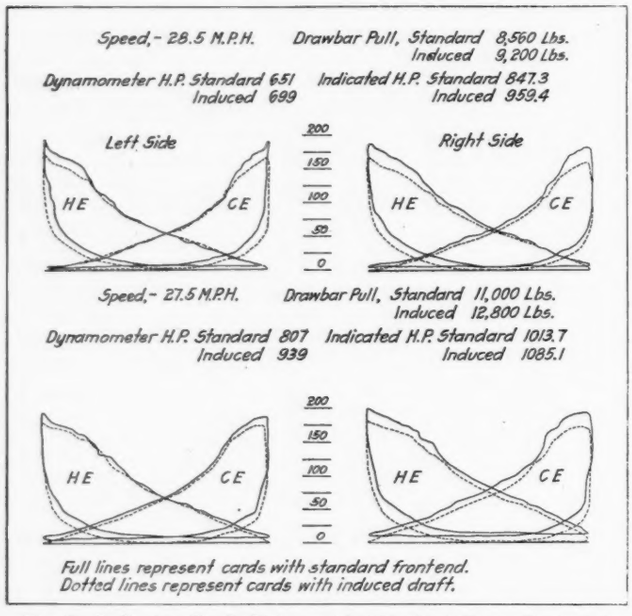


Fig. 2—Indicator Cards Taken with Standard Front End and with Induced Draft

maximum power of the Mallet was developed at a speed of approximately 17 miles an hour and that drawbar horsepower and back pressure horsepower equalized at a speed of approximately 25 miles per hour, showing that at this speed the locomotive exerted 950 drawbar horsepower and that an equal power was required to draft the boiler. The curves for the consolidation type show that the maximum power of the locomotive was developed over a wide range of speeds and that

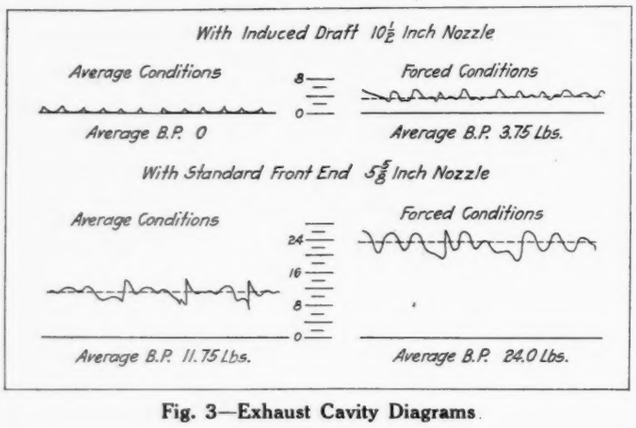


Fig. 3—Exhaust Cavity Diagrams

back pressure horsepower was not appreciable except at high speed.

The data accumulated from a great many tests conducted over the various divisions of the Santa Fe system, have shown the desirability for some other method of furnishing draft for locomotives to supplant that now commonly used. These tests have forcibly demonstrated the inefficiency of the present arrangement when viewed from a thermodynamic standpoint. The chief advantage in favor of the present arrangement is that it is very efficient speaking from a purely mechanical standpoint; that is, it is free from any complicated parts which are liable to get out of adjustment and does its work when once it has been set up with very little attention other than minor adjustments to keep it in good working order. It is this feature alone that has enabled the present front end arrangement to exist to the present day. In view of existing conditions, attention was attracted to the possibility of drafting a locomotive by some method of forced or induced draft, but because of the impracticability of installing a system of forced draft on a locomotive, except possibly in the case of stoker-fired locomotives where it is not necessary to open the fire door, this form of draft was abandoned and attention directed to the adaptation of induced draft for the purpose. It is a well known fact that induced draft has been successfully applied in stationary and marine service, and its development in these fields has been rapid during the past few years, so that we now have many installations of this character. The development of the steam turbine and progress in the theory and construction of centrifugal fans for this work has added much to the progress made and it seemed logical that if the system could be so successfully applied to other fields, it would find ready application to the locomotive.

The problem, however, was not as simple as it at first ap-

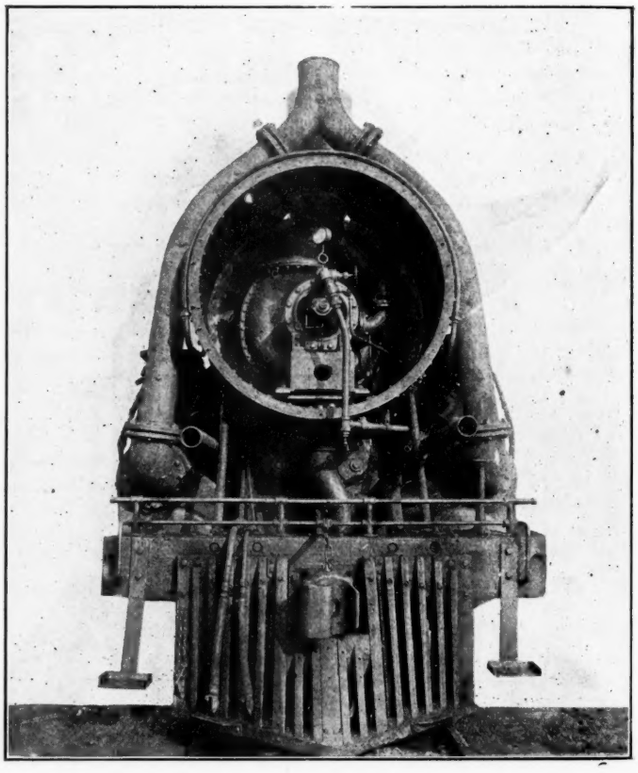


Fig. 4—Front of a Locomotive Fitted with the MacFarland Fan Draft

peared. Although there were many existing installations of induced draft, and several manufacturers making a specialty of these installations, yet they were not readily adaptable to the locomotive. In power plant and marine service the space occupied by the draft apparatus is not as important an item as with the locomotive. When the problem of furnishing draft apparatus of this character was presented to the manufacturers, they were able to calculate the size of the fan and the horsepower necessary to drive it to burn the required amount of coal per hour, but when the space that such an apparatus would occupy was taken into consideration, they were astounded, and were not able to furnish either data or apparatus satisfactorily to meet the requirements. For this reason it was absolutely necessary to start in at the beginning and develop such an apparatus.

The first step in the development was to secure data showing just what could be expected in draft obtainable, in fuel consumption, in boiler efficiency, and in power requirements to operate a fan draft system. Locomotive 932 was secured for experimental purposes and an experimental plant constructed to secure the data. The test was confined to the boiler of the locomotive with a 48-in. ventilating fan attached to the smokebox. No attempt was made at this time to run the engine on the road. Connection was made between the inlet of the fan and the smokebox of the locomotive so that the exhaust was through the fan rather than through the ordinary stack. The fan was driven by means of a 25-horsepower constant speed motor, belt connected. The variation in speed at which the fan was driven was accomplished by changing the diameter of the pulleys. The power necessary to drive the fan at various speeds for direct connection to a 40 horsepower steam turbine, the entire apparatus being so constructed as to be a compact unit suitable for application in the ordinary smokebox of a locomotive. Preliminary tests were made with this unit, during which the volume of air at atmospheric pressure and temperature, discharged at various turbine speeds, was determined when the fan was operated against various resistances simulating locomotive service. These tests indicated that the fan was of sufficient size for the locomotive for which it was ordered, so that application of the apparatus was made to locomotive 1302 at Topeka shops in January, 1913. The first actual test of the apparatus installed on this locomotive was made on January 12, 1913. It was soon apparent that the 24-in. fan did not have the capacity to furnish the necessary draft, and it was not until after a great deal of experimental work, during which it was

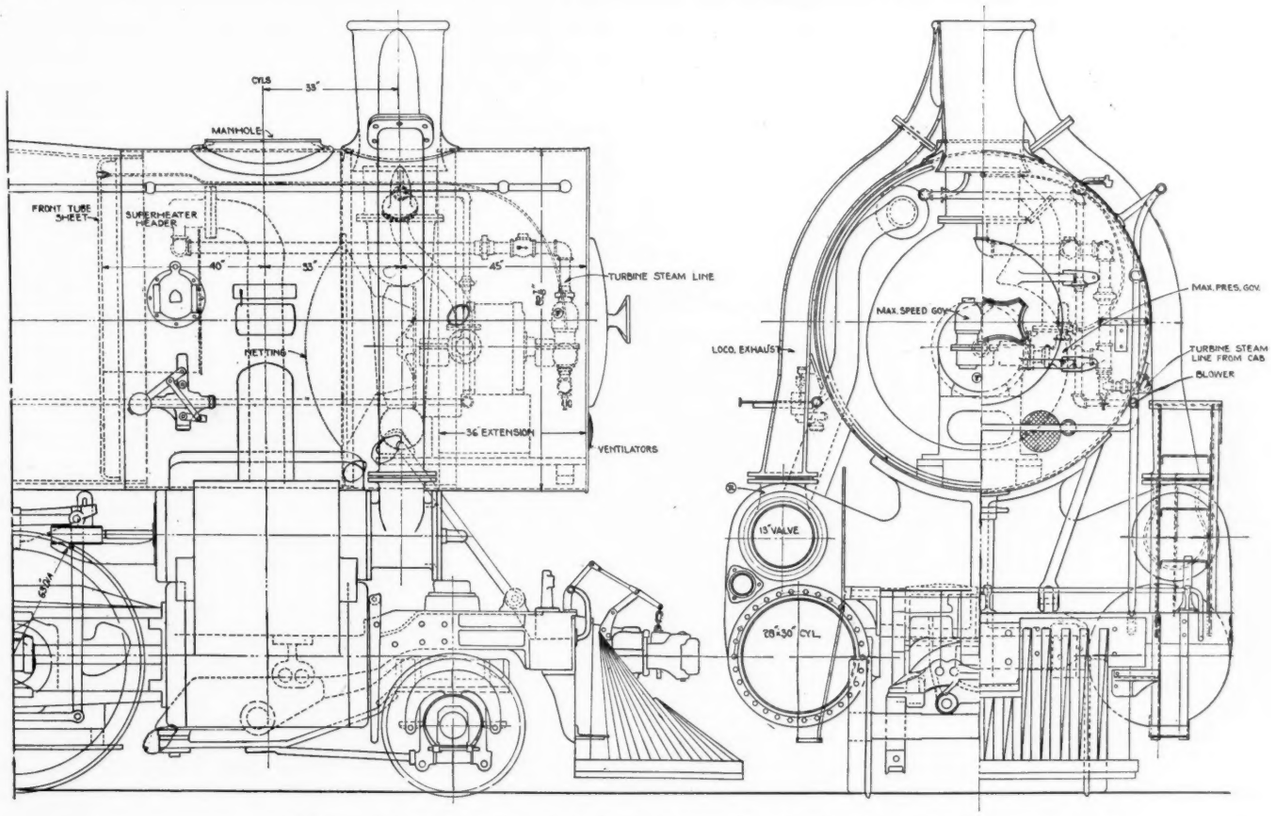


Fig. 5—MacFarland Fan Draft Applied to a Mikado Type Locomotive

was accurately determined by measuring the current necessary to drive the motor. With this arrangement a series of tests were made in Topeka, Kan., in February, 1912. A maximum of 3,350 lb. of coal was burned per hour, and a maximum of 830 boiler horsepower was developed. This was accomplished at an expenditure of 20 horsepower required to drive the 48 in. fan at an average speed of 715 revolutions per minute; the maximum draft in the smokebox was 2⅞ in. of water. The first tests in the series were made with the diaphragm in place in the smokebox, but this was removed during the latter runs and it was found that with the fan draft it was possible to get a very uniform distribution of the draft without employing deflector plates of any kind. It was not possible to develop anywhere near the maximum boiler horsepower with this installation, but valuable data were secured for use in the construction of an experimental unit for drafting purposes.

From the data obtained from these preliminary tests with the 48 in. fan applied to both coal and oil burning locomotives, an experimental unit adaptable to locomotives was furnished by the manufacturers and delivered to Topeka in September, 1912. This unit consisted of a stock 24-in. fan with special provision necessary to design and build three fan rotors and make modifications of the fan casing, that a fan of sufficient capacity was secured to permit of actual road tests. During the development of these fans, however, several stationary and road tests were made with the locomotive, during which valuable data were secured.

Prior to tests with the fan draft apparatus, complete tests of the locomotive with the standard front end arrangement had been made for a basis of comparison of results obtained with the two arrangements. Typical indicator cards secured under the various conditions show the possibilities of the fan draft in eliminating the back pressure of the engine. While the fan used during the later series of tests was not mechanically correct or of sufficient capacity to develop the maximum power of the locomotive, it was of sufficient capacity to bring out many valuable points relative to the general performance to be expected from a system of this kind. The locomotive burned its fire as satisfactorily with the fan draft arrangement as with the standard front end arrangement, and there was no more tendency for the fire to bank or clinker. A uniform draft varying from 4 in. to 6¼ in. of water was maintained with the fan draft.

The capacity of the fan was limited to the maximum safe speed at which it could be run, and when the demand upon the boiler was such that it could be supplied with the draft available within the maximum speed of the fan, there was an economy shown. This was evident when the locomotive was working on grades, where, although more steam was used per stroke, the relatively low speed of the locomotive made the total steam consumption lower than on the level stretches where less steam was used per stroke, but the higher speed and consequent increase in the number of strokes per unit of time, placed a demand for steam on the boiler which could not be supplied by the draft available with the fan. For this reason, it was not possible to maintain full boiler pressure at all times with the fan draft arrangement, so that the initial pressure available in the cylinders was from 12 lb. to 13 lb. lower from runs with the fan draft than runs with the standard front end arrangement. Analyses of the indicator cards show that although there was a gain in power as indicated by an increased area at the bottom of the cards, there was a corresponding decrease at the top of the card. This was due to the difference in initial pressure, so that the gain in power due to the elimination of the back pressure was just about sufficient to operate the fan draft apparatus, and there was no apparent gain in the over-all efficiency of the locomotive. This is demonstrated by the indicator cards in Fig. 2.

A comparison of the performance of the locomotive under the two systems of drafting during periods in the runs when such comparison is at all possible, that is, when working conditions are similar, is favorable to the induced draft arrangement. Such a comparison based upon the actual power delivered at the drawbar shows a saving of nearly 20 per cent in fuel for the fan draft, and it is entirely possible to effect a marked saving in indicated horsepower with it.

Typical exhaust cavity cards are shown in Fig. 3. These pressure readings were taken in the exhaust cavity of the valves by means of an independent indicator fitted with a 20-lb. spring. They were chosen to cover the entire field as nearly as possible.

The conclusions drawn from these comparative tests were that it is entirely possible to draft a locomotive boiler by means of an induced draft fan to replace the exhaust tip commonly used; that it is possible to entirely eliminate the cylinder back pressure under normal conditions and greatly reduce it under forced conditions of operation of the locomotive; that with equal steam chest pressures, cut-offs, and speeds there is an appreciable increase in indicated horsepower due to the elimination of the cylinder back pressure, and that it is entirely possible to successfully operate an installation of this character at the necessary high speed during intervals of time representing a run over the average division of a railroad.

The logical field for locomotive mechanical draft is upon compounds in general and Mallet compounds in particular, where the excessive back pressure results in more pronounced cylinder losses. The development of this branch of locomotive engineering will necessarily be gradual, on account of the absence of data or lack of experience on the subject.

The experience gained with tests of the 24-in. fan unit applied to locomotive 1302 led to the design of a special 30-in. unit. The fan for this unit was constructed along the lines of the later development with the 24-in. fan which had given the best service on locomotive 1302. The new design embodied several improvements in size and proportioning of parts. Attention was given to the adaptation of the design to work at the peripheral speed found most desirable and provision was made for improved lubricating facilities and a maximum speed governor for protection.

One of these units was applied to a New York Central switching locomotive, and comparative tests were made before and after installation near West Albany, N. Y., in January and February, 1914. This locomotive was of the 0-6-0 class, built after the design which is standard for this class of power for the New York Central Lines. It was equipped with a Schmidt superheater, had a calculated tractive effort of 33,150 lb., cylinders 21 in. by 28 in. and 57-in. drivers, a total heating surface of 2,020 sq. ft., a superheating surface of 382 sq. ft., and a grate area of 31.5 sq. ft. The tests were confined to short runs between West Albany and Karners, N. Y., a distance of eight miles upgrade, and were made primarily to determine the suitability of the MacFarland fan draft for drafting switching locomotives, with a view of developing a system of draft which would insure noiseless operation.

This installation of the fan draft was never satisfactory from a mechanical standpoint, because the unit employed was not adapted to the size of the smokebox on this particular locomotive, but the tests further demonstrated the possibilities of this form of draft for locomotives, and justified the conclusion that the engine could be successfully drafted with the MacFarland fan draft. A maximum of 9 in. of draft was developed in the front end with an average of 8¼ in. throughout one of the test runs, and the fan operated successfully against depths of fire ranging from 6 in. to 18 in. The exhaust could be muffled to any desired point by the introduction of proper netting stages and the engine could be operated practically without smoke. The full operating steam pressure was readily maintained and the back pressure was entirely eliminated.

The experience with the fan draft gained from actual tests led to the development of an automatic control system to govern or regulate the speed of the turbine, and consequently regulate the intensity of the draft. It was found that it was highly desirable to make the operation of the fan as nearly automatic as possible and not have to depend on the engineer or fireman to regulate its action. At the same time, its operation should be under the control of the fireman at all times should he choose to exercise control. The essential features of the automatic control system which have been developed are the provision of both maximum speed and pressure governors and an arrangement which insures the starting of the turbine at the time the main locomotive throttle is opened, and shutting off when the throttle is closed. In addition to these features, an independent steam line is provided which makes possible the operation of the turbine at nearly its maximum speed when the locomotive is standing.

The maximum speed governor is made a part of the steam turbine itself and is designed to automatically throttle the supply of steam into the turbine when the pre-determined maximum safe speed has been reached. The maximum pressure governor is fitted into the steam line supplying the turbine and is so constructed that the flow into the turbine is automatically throttled when the locomotive boiler pressure has reached within a few pounds of the normal working pressure. This governor is also fitted with an attachment which makes possible the control of steam through the valve from the locomotive cab. An installation applicable to a Mikado type locomotive embodying all these features is shown in Fig. 5.

DEAD TRAIN ORDERS

By J. L. Coss

To promote prompt movement of trains, despatchers can lend a helping hand by closely watching dead orders. It requires time for an operator to clear a train with a hand full of orders, the conductor to read their contents to the operator and the engineer to read them to the conductor; and if any of the orders delivered are dead, just that much time is wasted. The train despatcher is, of course, held responsible for this lost motion; it is therefore, up to him to guard against the delivery of such orders. A despatcher should work close with his operators and instill into them the importance of watching this feature at their respective offices. They should call the despatcher's attention to any order which in their opinion is no longer necessary. The operator may be busy, it is true; but if operators are educated in this matter they can be of great assistance to the despatcher.

There is danger in the practice of allowing orders of a precautionary nature, such as reducing speed over certain pieces of track, bridges, etc., to remain in force after the repairs have been made, because the train and engine men become acquainted with the facts and they will be likely to take chances somewhere else, thinking perhaps the despatcher has forgotten to take up the order. It is the general practice on most roads to revise and consolidate all slow orders under a new number just after midnight. If, then, after the slow orders have been sent out a telegram comes in giving an O. K. on a certain place which has been covered in the new order the despatcher, if easy going, will allow that place to remain in the order until the next night at midnight. This entails much waste of energy. The moment an O. K. on any place is received a new and corrected order should be put out. Then the enginemen will adhere closely to the contents of all slow orders.

Each roadmaster, supervisor and trainmaster should receive a copy of all slow orders each morning, look them over carefully and immediately apprise the chief despatcher of anything irregular.

I have heard roadmasters complain that certain parts of slow orders were not being complied with by enginemen, and request that a "31" order be used for the place in question. But why burden the despatcher by having him use that form? There is no more important order than a slow order, and if an engineman will ignore that he is liable to do the same on a "31" order. If the roadmaster or any one else finds a man not complying with a slow order he should report the fact to the proper officer.

For the despatcher, however, the main feature is, keep your slow orders up to date and do not let it be said by enginemen, when you hand them an order, that they know a particular place was repaired a week ago because the foreman in charge of the work has so advised. Also, when it becomes necessary to abandon a certain switch or side track, as is frequently done, cover it by a general order addressed to all concerned, the order to be placed in a book to be signed for by train and enginemen. Do not put it out day after day in your slow orders. Where the necessary precautionary features are provided for in the book of rules, or time table notes, do not burden your slow order book with matters thus covered.

ARBITRATION OF ENGINEMEN'S DEMANDS

W. S. Carter, president of the Brotherhood of Locomotive Firemen and Enginemen, was the principal witness last week at the hearing before the board of arbitration on the demands of the western firemen and engineers. Much of his testimony was in explanation of a large volume he introduced as an exhibit, comparing the wage scales in 46 industries in 16 cities with those of engineers and firemen in freight service on roads that have a 10-hour basis, to show, as he said, that most of the men in the other industries receive higher rates of pay, have received larger increases since 1907 and since 1910 than enginemen, and that the latter, while required to work hours far in excess of employees in other industries, receive much less compensation for overtime.

The classes of employees which he said rank higher in hourly rate of pay than engineers include bricklayers, plasterers, steamfitters, plumbers, gasfitters, marble setters, structural iron workers, cement workers, granite cutters, compositors, stone cutters, inside wiremen, carpenters and linotype operators. The hod carrier in these cities, he said, receives an average wage of 40.27 cents an hour, while the locomotive fireman on coal-burning engines in freight service receives 33.85 cents, and on oil-burning engines 32.86 cents. The engineers stood sixteenth in the list in 1913 and firemen on coal-burning engines thirty-eighth and on oil-burning engines thirty-ninth. In a table arranged to show percentages of increase, 1913 over 1907, the engineers ranked thirty-ninth and firemen on coal-burning engines ranked thirty-sixth, while those on oil-burning engines ranked forty-fourth. Comparing overtime rates he said that an engineer on a $6.40 a day engine would get $6.40 for 8 hours or 10 hours, $7.68 for 12 hours and $8.96 for 14 hours, while a plasterer would get $6 for 8 hours, $9 for 10 hours, $12 for 12 hours and $15 for 14 hours.

One part of his exhibit included a discussion of piece work and seniority, in which he said that so long as the speed of a train is equal to or exceeds 10 miles an hour the wages are on a piece-work basis, or so much per 100 miles, and as the speed of the train increases the earnings for a given time are increased, but this he said does not take into consideration that a crew may be called two hours before starting to make mileage, or may be delayed afterward. "It is difficult to determine when a man goes on duty," he said, "he may be asleep after eight hours rest at 2 o'clock in the morning. The caller or the telephone may waken him and his train leaves two hours later. It takes him a certain time to put his clothes on, get something to eat, and get to the place where he will find his engine. Possibly that is his own time, but that is something that has to be done. It is difficult therefore to say just how much time after a man is called is really time contributed by himself or required by the company. Some schedules provide for pay for preparatory time working around the engine and others do not. As in all industries where rates of wages are based on the piece-work system a comparatively few locomotive enginemen earn high wages, and the high wages of these few are accepted by the public as typical of the earnings of all. An engineer or fireman may earn two days' pay in one day with the knowledge that he may earn nothing the next day, or may earn in one busy month twice as much as in a dull month.

There is no class of labor whose opportunities to earn money are so precarious as those of the fireman for his many years of experience. This he attributed to the peculiarity of railroad employment. On account of the seniority system, he said, the oldest men may earn high wages because they get the high-speed trains, but on the other hand the highest man on the firemen's list may be promoted to engineer and find his earnings decreased or may be demoted to fireman and find himself way down on the list again. The seniority system, however, he said, is absolutely necessary, bad as it is.

Mr. Carter said that the public and even some members of the Interstate Commerce Commission had been "grossly misled" by erroneous methods of reporting wages formerly required by the commission. Some roads, he said, have reported to the commission only the number of employees in service on June 30 on one form, and on another have reported the total compensation paid during the year. Dividing this compensation by a smaller number of men, therefore, gives an average rate that is too high. Figures compiled on this basis, he said, were used in the eastern enginemen's arbitration, but the commission has since recognized the error and has changed the method of reporting. The commission's statistics are also misleading, he said, in showing increases in pay without showing that the increases were brought about by the introduction of larger engines on which higher rates were paid.

Much of the effect of Mr. Carter's comparative tables was destroyed on cross-examination by James M. Sheean, counsel for the railroads, who showed that as the wage scales used for other industries are all for time rates they are not properly comparable with any of the "piece-work" or mileage rates of the railroads, and that the rates given for the railroads are only comparable when the enginemen are working on the hourly basis or when the speed is not greater than 10 miles an hour. This excluded the effect of the rates for passenger service, which are practically all on the mileage or piece-work basis; no distinction was made between the fast freight and other freight rates, although much of the fast freight service is paid for on the mileage basis, nor for the higher rates paid for way freight service.

Mr. Carter said his tables were intended only to show average rates, not earnings; that it would be impracticable to show earnings. He also said that his average rates had been ob-

tained by simply adding together all rates shown in the schedules for large and small locomotives, without regard to the number of each or whether any of them actually paid the rate. "So that if one engine took a $4 rate and 999 engines took a $6 rate, you would show the average rate as $5?" asked Mr. Sheean. Mr. Carter admitted this was true, but said he did not hesitate to criticise this method of reaching averages. Mr. Sheean also called attention to the fact that the rates for other indusries apply only to the large cities, while the railroad rates cover a wide extent of territory. Mr. Carter also admitted that he knew of no other industry that has a provision for a day's pay for less than a day's work. He also admitted that the number of men retained on the extra board is largely in the hands of the men themselves and that in dull times, under the seniority system, the older men may cause the younger men to drop out of service in order to keep their own earnings up, as opposed to the practice in other industries of reducing the hours of all the men.

He said he had made no investigation of the continuity or certainty of employment in other industries, and admitted that in the case of assigned crews their earnings are regular; that if called in emergency for another run they are guaranteed the same or higher rates. He said the only reason that switch enginemen have not asked for an eight-hour day is that they could not make a living in eight hours.

In reply to questions by Mr. Nagel, one of the arbitrators, as to whether the uncertainty and irregularity of employment in the case of engineers and firemen can be fairly compared with the uncertainty in the case of industrial wage earners, Mr. Carter said that the "panics" which throw men out of employment in mill industries at certain intervals of time occur on railroads, sometimes two or three times a year. Mr. Byram asked the witness if he thought it would be possible for the railroads to find enough money to give all of their employees what he would consider an adequate payment. Mr. Carter replied that he thought if it were possible to put it to a referendum vote the people of the United States would vote for higher rates if they knew the increase would go to increase wages. Mr. Nagel asked whether the entire rate question of railroads ought not to be considered, with a view to proper service for the shipper and passenger and proper conditions for the employees. Mr. Carter agreed, and thought the consumer would be liberal, but that the shipper considered only his freight rates.

Mr. Carter also introduced an exhibit on the earnings of enginemen during their first year's service, and the effect thereon of fluctuations in railroad business, based on information furnished by the railroads, to show that a large proportion of the younger men in the service have irregular employment and therefore receive low earnings. This showed that of 4,098 engineers promoted since January 1, 1912, 2,249 or 54.88 per cent have earned for the months worked an average of less than $80 per month. Of 1,296 hired engineers 518, or 39.97 per cent, have earned for the months worked an average of less than $90 a month.

Of 23,919 firemen hired, 10,786, or 45.09 per cent, have earned for the months worked an average of less than $50 per month. He said that if all months had been considered the earnings would have been much less. On February 1, 1914, there were 32,038 men on the engineers' list for the roads reporting, and 5,229 on the engineers' extra list, while 5,451 engineers had been set back to firing. On the firemen's list there were 29,645 and on the firemen's extra list 7,197. The number of firemen hired between January 1, 1912, and February 1, 1914, was 23,919. Mr. Carter said that most of the men that entered the service found out that they didn't like it, that their earnings were not high enough or that the work was too hard, and very few remain long enough to get the more highly paid runs. Over 12 per cent of the engineers and firemen promoted earned less than $20 per month. He said that in times of great depression in railway traffic it is not unusual to find all of the passenger engines and most of the regular freight engines fired by men who have been demoted. For all the roads reporting, the oldest fireman had an average of 3.44 years' seniority as an engineer on February 1, 1914. Of the 29,645 firemen in service on that date, 5,451 were demoted engineers. Without seniority, he said, the irregularity in employment would be the same, except that instead of the burden falling on the younger men, the man who had charge of assigning the service would pick the men upon whom the burden would fall.

On some roads the introduction of larger engines had the same effect on the number of men employed as a depression in business, he said, "except that business might pick up, but the engines never will get little." He admitted, however, that the number of regularly assigned runs, which are less affected by fluctuations, is gradually increasing. On cross-examination Mr. Sheean showed that many of the men listed as having small earnings as engineers earned far larger amounts in the same months as firemen, and that the list included men who might not have been available for service.

Mr. Carter remarked several times during his testimony that the employees would be willing to enter into a profit-sharing basis of wages if they could manage the roads, and that if the employees had jurisdiction over the financial affairs the money would be spent differently. Mr. Park asked: "Isn't it a fact that nearly all of the presidents and managing officials did start as firemen or machinists, or clerks, or operators, or agents? Do you think that the firemen without any experience, or with the experience they have had, would be more competent to run these railroads?" Mr. Carter replied: "If we owned the railroads we would hire the same presidents, but we would tell them what to do with our money."

Mr. Nagel asked if the government took over the roads, whether compensation would be continued at the rates which now obtain, or be raised or lowered? Mr. Carter said he hoped the government will not take over the railroads, but that if it were done, he believed the men would be placed on an eight-hour-day basis, and under civil service and that perhaps to the section men and clerks it would be a godsend, but he doubted whether it would be to the advantage of the organized crafts.

Mr. Carter admitted, in reply to questions by Mr. Sheean, that standardization of earnings could not be brought about unless the standard rates and rules proposed were applied to a uniform base, but said that the "saving clause" in the arbitration agreement indicated the "conservatism" of the men; because they had asked for standardization at lower rates than the highest now in effect, but wished to protect the higher rates. If they had been radical, he said, they would have asked for standardization on the basis of the highest rates in effect.

Mr. Carter also introduced an exhibit to show the increased cost of living since 1910 of enginemen in 29 western railroad towns, based on reports by special investigators who interviewed the merchants and secured affidavits from them as to the accuracy of the figures. Out of 111 articles of groceries, he said that there had been increases in the retail prices for all but 11, ranging from 0.54 per cent to 44.82 per cent; on meats, an increase of about one-third, and on men's clothing from 12 to 20 per cent. He also submitted tables taken from government figures and other exhibits bearing on the cost of living. Asked by the chairman whether the railroads intended to controvert the proposition that there has been an increase in the cost of living during the past four years, Mr. Sheean said "we contend that the increase in the cost of living is no greater in ratio than the increased earnings of the men during the same period."

Mr. Carter was followed on the witness stand by a number of engineers and firemen, who testified concerning their working conditions.

Extensive Electrification on the St. Paul

First Step Toward the Equipment of 440 Miles for Electric Operation; 3,000 Volts, Direct-Current Adopted

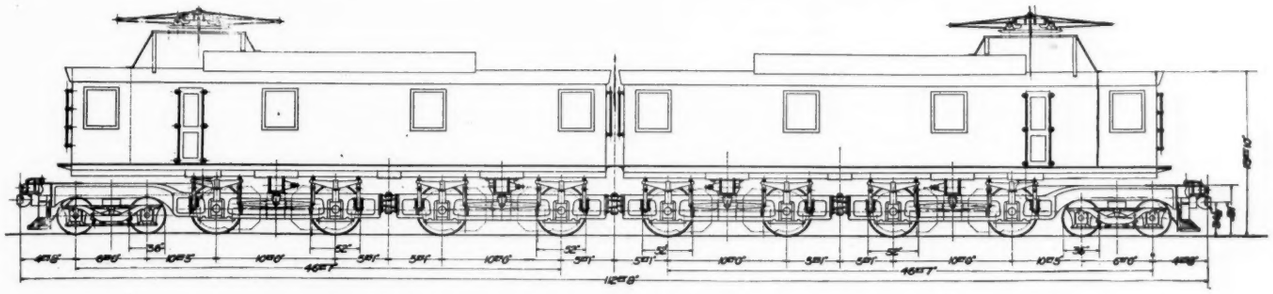
Plans for the electrification of the first engine division of the Puget Sound lines of the Chicago, Milwaukee & St. Paul* have been completed and contracts let to the General Electric Company for the electric locomotives, substation apparatus and line material, and to the Montana Power Company for the construction of the transmission and trolley lines. The work is under the direction of C. A. Goodnow, assistant to the president, in charge of construction. This initial electrification of 113 miles of main line between Three Forks and Deer Lodge is the first step toward the electrification of four engine divisions extending from Harlowton, Mont., to Avery, Idaho, a total distance of approximately 440 miles, aggregating about 650 miles of track, including yards and sidings. While this comprises the extent of track to be equipped in the near future, it is understood that plans are being made to extend the electrification from Harlowton to the coast, a distance of 850 miles, should the operating results of the initial installation prove as satisfactory as anticipated.

The plans for this work are of special interest, as this is the first attempt to install and operate electric locomotives on tracks extending over several engine divisions, under which conditions it is claimed the full advantage of electrification can be secured. The various terminal and tunnel installations have been made necessary, more or less, by reason of local conditions; but the electrification of this road is undertaken purely on economic grounds, with the expectation that superior operating results with electric locomotives will effect a sufficient reduction in the present cost of steam operation to return an attractive percentage on the large investment required. If the anticipated savings are realized in the electric operation, this initial installation will constitute one of the most important milestones in electric railway progress.

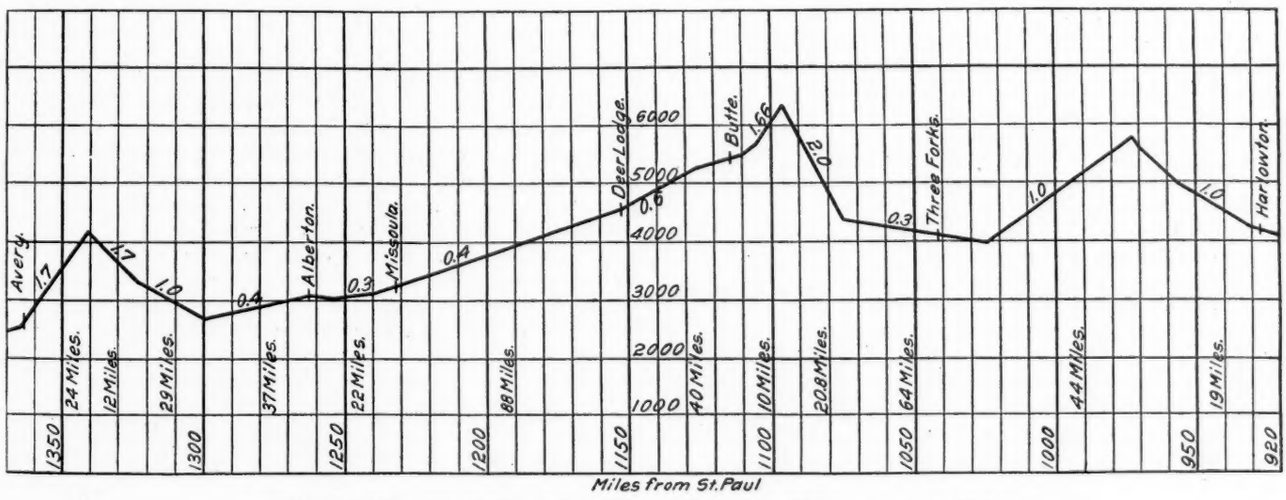
Due to the facilities available and the low cost of construction under the favorable conditions existing, the railway company will purchase power at a contract rate of $0.00536 per kilowatt-hour, based on a 60 per cent load factor. It is expected under these conditions that the cost of power for locomotives will be considerably less than is now expended for coal. The contract between the railway and power companies provides that the total electrification between Harlowton and Avery, comprising four engine divisions, will be in operation January 1, 1918.

In order to connect the substations with the several feeding-in points of the Montana Power transmission lines, a tie-in transmission line is being built by the railway company that will permit feeding each substation from two directions and from two or more sources of power. This transmission line will be constructed with wooden poles, suspension type insulators, will operate at 100,000 volts, and will follow, in general, the right of way of the railway company, except where advantage can be taken of a shorter route.

The immediate electrification of 113 miles will include four substations containing step-down transformers and motor-generator sets with necessary controlling switchboard apparatus to convert 100,000-volt 60-cycle three-phase power to 3,000 volts



Elevation of the Locomotives to Be Used on the St. Paul's Electrified Lines



Chicago, Milwaukee & Puget Sound from Harlowton, Mont., to Avery, Idaho

*See *Railway Age Gazette*, January 2, 1914, page 19.

direct current. This is the first direct current installation using such a high potential as 3,000 volts, and this system was adopted in preference to all others after a careful investigation extending over two years. The 2,400-volt direct current installation of the Butte, Anaconda & Pacific in the immediate territory of the proposed electrification has furnished a demonstration of high voltage direct current locomotive operation during the past year and a half, and the selection of 3,000 volts direct current for the St. Paul was due in a large measure to the satisfactory performance of the Butte, Anaconda & Pacific installation.

The substation sites of the Chicago, Milwaukee & Puget Sound electrified zone provide for an average intervening distance of approximately 35 miles, notwithstanding that the first installation embraces 20.8 miles of 2 per cent grade westbound and 10.4 miles of 1.66 per cent grade eastbound over the main range of the Rocky Mountains. With this extreme distance between substations and considering the heavy traffic and small amount of feeder copper to be installed, it becomes apparent that such a high potential as 3,000 volts direct current permits of a minimum investment in substation apparatus and considerable latitude as to location sites. The substations will be of the indoor type, transformers being three-phase, oil cooled, and reducing from 100,000 volts primary to 2,300 volts secondary, at which potential the synchronous motors will operate. The transformers will be rated 1,900 and 2,500 kv-a. and will be provided with four 2½ per cent taps in the primary and 50 per cent starting taps in the secondary.

The motor-generator sets will comprise a 60-cycle synchronous motor, driving two 1,500-volt direct current generators connected permanently in series for 3,000 volts. The fields of both the synchronous motor and direct current generators will be separately excited by small generators direct connected to each end of the motor-generator shaft. The direct current generators will be compound wound, will maintain constant potential up to 150 per cent load and will have a capacity for momentary overloads up to three times their normal rating. To insure good commutation on these overloads, the generators are equipped with commutating poles and compensating pole-face windings. The synchronous motors will also be utilized as synchronous condensers, and it is expected that the transmission line voltage can be so regulated thereby as to eliminate any effect of the fluctuating railway load.

The location and equipment of the several substations is as follows:

Station	Miles from Deer Lodge	No. of units	Kw. per unit	Total
Morel	17.1	2	2,000	4,000
Janey	50.5	3	1,500	4,500
Piedmont	77.9	3	1,500	4,500
Eustis	120.6	2	2,000	4,000

The trolley construction will be of the catenary type, in which a 4/0 trolley wire is flexibly suspended from a steel catenary supported on wooden poles, the construction being bracket wherever track alinement will permit and cross-span on the sharper curves and in yards.

As the result of careful investigation and experiments, a novel construction of trolley will be installed, composed of the so-called twin-conductor trolley. This comprises two 4/0 wires suspended side by side from the same catenary by independent hangers alternately connected to each trolley wire. This form of construction permits the collection of very heavy current by reason of the twin contact of the pantograph with the two trolley wires, and also insures sparkless collection under the extremes of either heavy current at low speed or more moderate current at very high speeds.

Including sidings, passing and yard tracks, the 113 miles of route mileage is increased to approximately 168 miles of single track to be equipped between Deer Lodge and Three Forks in the initial installation.

The locomotives to be manufactured by the General Electric Company are the first to be constructed for railroad service with direct-current motors designed for so high a potential as 3,000 volts. They will weigh approximately 260 tons and will have a continuous capacity greater than any steam or electric locomotive yet constructed. Perhaps the most interesting part of the equipment is the control, which is arranged to effect regenerative electric braking on down grades. This feature as yet has never been accomplished with direct-current motors on so large a scale.

The Chicago, Milwaukee & Puget Sound, from Harlowton to the coast, crosses four mountain ranges, the Belt mountains at an elevation of 5,768 ft., the Rocky mountains at an elevation of 6,350 ft., the Bitter Root mountains at an elevation of 4200 ft. and the Cascade mountains at an elevation of 3,010 ft. The first electrification between Three Forks and Deer Lodge calls for locomotive operation over 20.8 miles of 2 per cent grade between Piedmont and Donald at the crest of the main Rocky mountain divide.

The initial contract calls for nine freight and three passenger locomotives having the characteristics given below and similar in all respects, except that the passenger locomotives will be provided with a gear ratio permitting the operation of 800-ton trailing passenger trains at approximately 60 m. p. h., and will be equipped with an oil-fired, steam-heating outfit for the cars.

The eight motors for the complete locomotive will be type GE-253-A. This motor has a normal one-hour rating of 430 horsepower, with a continuous rating of 375 horsepower. The eight motors will thus give the locomotive a one-hour rating of 3,440 horsepower and a continuous rating of 3,000 horsepower. The drawbar pull available for starting trains will approximate 120,000 lb. at 30 per cent coefficient of adhesion.

Each motor will be twin-geared to its driving axle in the same manner as on the Butte, Anaconda & Pacific, the Detroit River Tunnel and the Baltimore & Ohio locomotives, a pinion being mounted on each end of the armature shaft. The motor is of the commutating pole type and has openings for forced ventilation from a motor-driven blower located in the cab.

The freight locomotives are designed to haul a 2,500-ton train on all grades up to 1 per cent at a speed of approximately 16 m. p. h., and this same trainload unbroken will be carried over the 1.66 and 2 per cent ruling grades on the west and east slopes of the Rocky mountain divide with the help of a second similar freight locomotive acting as pusher. Track provision is being made at Donald, the summit of the grade, to enable the pusher locomotive to run around the train and be coupled to the headend to permit electric braking on the down grade. In this case the entire train will be under compression and held back by the two locomotives at the headend, the entire electric braking of the two locomotives being under the control of the motorman in the operating cab of the leading locomotive. It is expected that electric braking will prove valuable, as in addition to providing the greatest safety in operation, it also returns a considerable amount of energy to the substations and transmission system. In this connection, the electric locomotives will have electric braking capacity sufficient to hold back the entire train on down grade, leaving the air brake equipment to be used only in emergency and when stopping the train.

With the completion of the remaining engine divisions, it is proposed to take advantage of the possibilities afforded by the introduction of the electric locomotive by combining the present four steam engine divisions into two locomotive divisions of approximately 220 miles length, changing crews, however, at the present division points.

The general characteristics of the locomotives are given below:

Total weight	260	tons
Weight on drivers	200	tons
Weight on each guiding truck	30	tons
Number of driving axles	8	
Number of motors	8	
Total length of locomotive	112	ft.
Rigid wheel base	10	ft.
Voltage	3,000	
Voltage per motor	1,500	
Horsepower rating, one hour, each motor	430	
Horsepower rating, continuous, each motor	375	
Horsepower rating, one hour, complete locomotive	3,440	
Horsepower rating, continuous, complete locomotive	3,000	
Trailing load capacity, 2 per cent grade	1,250	tons
Trailing load capacity, 1 per cent grade	2,500	tons
Approximate speed at these loads and grades	16	m. p. h.

THE MANUAL BLOCK SYSTEM WITHOUT STATION ATTENDANTS

That the block system or space-interval system is the only adequate and satisfactory arrangement for running trains at high speeds with a suitable degree of freedom from the collision hazard has come to be quite generally appreciated, although the American railway world has been a long time in reaching this point. That the system can be managed with a good degree of flexibility, to meet needs imposed by changes in the volume of traffic or by lack of money, is not so well appreciated. As showing the adaptability of the principle to conditions which usually are considered unfavorable to its adoption, except at unreasonably high cost, we describe below two small installations—one of them in use only about six weeks—where no station operators are employed. In both cases the trainmen perform the functions of the station man.

ELECTRIC TRAIN STAFF ON THE LONG ISLAND

The Long Island road, on its Whitestone branch, is using the electric staff system without station attendants, the conductor or his assistant changing the staffs at each stop. On this branch, four miles long, with two block sections, there are on week days about 25 trains each way, daily, nearly all passenger trains; and each staff station is at a passenger station, so that no extra stops are necessary to take staffs, except for the few freights. There are no express passenger trains. The electric train staff has been used in this way on a short section of the Delaware, Lackawanna & Western for several years, but on that section there are no passenger trains.

In one of the staff sections on the Long Island is a siding, where there is a junction staff instrument, by means of which a train clearing the main track, can clear the block for other trains. The conductor uses the staff to unlock the switch, and having cleared the main track, and locked the switch straight, can insert the staff in the instrument, thus making a staff available, at either end of that section, for a superior train.

There are no semaphores or other fixed visual signals on this staff-operated line. At each station is a booth outside the building, locked with a padlock; and in this the staff instruments are placed. The stations have high platforms and the car platforms are at the same level, so that the trainman can alight, go to the booth, unlock it, change the staffs, lock the door and return to the train in about ten seconds. Before going back into the train he holds the staff up where it can be seen by the motorman (all passenger trains are electric). Motormen and enginemen are required to see the staff before proceeding from a station. In each booth there is a telephone, connecting with the despatcher's office; but in the ordinary routine the passenger-train men have no communication with the despatcher; if the desired staff can be obtained (is not held in the machine by the electric lock) it is taken out at once, and the train proceeds.

All trains are required to keep clear of opposing superior trains, in accordance with ordinary time-table rights, so that observance of precise block-section limits is not necessary, and at staff stations trains can and do run to the station platform to discharge passengers.

LIGONIER VALLEY; FIVE BLOCKS CONTROLLED BY THE DESPATCHER

On the Ligonier Valley Railroad, which connects with the Pennsylvania main line at Latrobe, 40 miles east of Pittsburgh, the trains are run by the manual block system, without station operators; and there are no fixed signals, in the usual meaning of that term; the building, booth or box, containing the telephone with which conductors can speak to the train despatcher, being the recognized landmark by which the beginning and end of a block section are indicated.

This road is ten miles long, with a branch of four miles, and there are, altogether, five block sections. On the main line there are three passenger trains each way daily. The method of operation will be understood by a perusal of the rules for the block system, printed below. Freight trains are allowed to follow freight trains permissively, but under all other conditions the absolute space interval is maintained.

The usual procedure for the movement of a train through a single block is, for example, as follows:

The conductor goes to the telephone and says: "This is Conductor Brown, Extra 15 north, at Darlington Block Station." The despatcher then says to him "Block is clear (or caution) Darlington block station to Kingston block station, for Extra 15 north." The conductor then repeats the despatcher's exact words. The despatcher then closes the conversation by saying "O. K. Ligonier train director."

When train movements can be facilitated by giving an order conferring the right to the road for more than one block section, the regular form 19 is used. A sample order reads:

To C and E No 4 Latrobe Passenger Station
No 4 has clear blocks
Latrobe Block Sta to
Ligonier Block Sta

W. V. H.

In the occasional instances where the telephone wires or telephone instruments have been out of order, so as to prevent communication with headquarters, the trainmen have used the long distance Bell telephone to get instructions from the train director.

BLOCK SIGNAL RULES

38. Manual block system is in effect between Ligonier and Latrobe Block Station and on Mill Creek Branch between Ligonier and Wilpen.

Definitions

Block System—A series of consecutive blocks.

Block—A length of track of defined limits, the use of which by trains is controlled by block signal or block signal instructions.

Block Station—A place from which block signals are operated, or block signal instructions are received by telephone.

Unattended Block Station—A place at which block signal instructions are received by telephone.

Stations

Block stations will be located as follows and block system will be controlled by train director at Ligonier:

Ligonier—(telephone in train director's office).
Darlington—(in station building).
Kingston—(in station building).
Oakville—(in station building).
Latrobe Block Station—(Booth Junction, West Leg Y).
Wilpen—(in booth).

All above block stations are unattended except Ligonier. Telephones connected with the train director are installed at each block station.

General Rules

39. A train must not enter a block at a block station or between block stations without permission from the train director. The conductor or engineman must obtain from the train director permission to enter, and ascertain condition of the block. If the information concerning the block is received by the conductor, he must personally give it to the engineman, and the movement through the block must be made according to the instructions received from the train director. Trains clearing a block must report promptly to the train director.

40. Train director must not permit a train to enter a block which is occupied by an opposing train or by a passenger train, and a passenger train must not be admitted to a block which is occupied by any train except by train order, A freight train with proper instructions from the train director will be permitted to follow another freight train in the block.

41. Passenger extras must be given the same block protection as regular trains.

42. The condition of block over one block only will be given verbally; over more than one block, it must be in writing.

43. At an unattended block station, the conductor or engineman must obtain permission to enter, and ascertain the condition of the block; and report when clear of the block.

When a train clears a block between block stations or at an unattended block station, the flagman may, when authorized by the conductor or engineman, report clear to the train director.

44. If telephone fails at an unattended block station and trainmen cannot in the usual manner obtain instructions, every effort must be made to obtain instructions in some other manner and avoid undue delay. Such failures must be promptly reported to the train director from the most accessible point.

45. At unattended block stations, trains must run to but not beyond the building, booth or box which contains the telephone, unless otherwise instructed by train director.

USE OF TELEPHONES

46. The following instructions must be observed when the telephone is used for manual block operations, transmitting train orders or making any arrangements pertaining to the movement of trains.

Each person must satisfy himself that he is in communication with the person desired.

Train director and trainmen, when making arrangements by telephone for movement of trains, will be governed by the following instructions:

First: Trainmen calls train director by telephone.

Second: Train director answers "Ligonier train director."

Third: Trainman answers "Conductor ..... of train ..... at ....."

Fourth: Trainman asks for information or instructions desired.

Fifth: Train director gives information or instructions to trainman.

Sixth: Trainman repeats information or instructions given by the train director.

Seventh: Train director closes conversation by saying "O. K. train director, Ligonier."

Trainman must not consider any information or instructions from the train director as being completed and must not act upon such information or instructions until the train director has given "O. K.," followed by his name and office.

47. If there is not a proper supply of train order blanks and carbon sheets at an unattended block station or telephone booth, the fact must be promptly reported by telephone to the person from whom orders are received, who will arrange for necessary supply.

RAILWAY BUSINESS ASSOCIATION

The following officers were elected at the business session of the Railway Business Association which was held at the Waldorf-Astoria, New York, on Thursday afternoon, December 20: President, Geo. A. Post of New York; vice-presidents, S. P. Bush of Columbus, Alba B. Johnson of Philadelphia, H. G. Prout of New York, W. G. Pearce of New York, Walter H. Cottingham of Cleveland, W. B. Leach of Boston, E. B. Leigh of Chicago; treasurer, M. S. Clayton of New York.

An appropriate eulogy was adopted as a tribute to the late Charles A. Moore, who had been treasurer of the association since its formation.

The following resolutions were also adopted:

I—We again urge co-ordination of the various agencies of railway regulation. One of the most serious embarrassments under which the Interstate Commerce Commission labors is that it cannot enforce its findings when they conflict with state action. Until some permanent and satisfactory solution is reached, the federal commission should initiate and state commissions should join in conferences, exhausting all reasonable efforts toward co-operation. The country should consider its transportation problem not piecemeal but as a whole, with a broad outlook on the general prosperity. The financial condition of the railroads ought to be made plain to every public officer and no burden placed upon the railways without due consideration of the effect upon their net income.

II—We regard general rate advance cases as a proper subject of propaganda. As a matter of public policy the people have a vital interest in strengthening railway credit. They have the right to expresss their opinion and to promote public discussion.

III—We vigorously dissent from the view that the supreme concern of railway regulation is to avoid the risk of too much railway revenue. In business and in the affairs of government, what men dread is not a surplus but a deficit. The railroads should be put beyond reasonable doubt of having income enough. It is now known on the highest authority that their income is too low in the public interest. Various substitutes are proposed in place of advances in freight rates as a remedy. It has been demonstrated that some of these suggestions are not immediately practicable. Certain relief should be granted forthwith. National prosperity depends upon it. The people cannot afford mistakes on the wrong side of the ledger. Any superfluous surplus can be dealt with when and if it materializes.

IV—Underpayment of railways for carrying mail demands correction. Quadrennial weighings result in substantial increases in service performed without added compensation. The initiation of the parcel post service without adequate remuneration to the railroads aggravates this discrepancy. This inequity should be minimized through a change to annual weighings. Instead of this, the House has passed and the Senate is considering a method of payment based on advance estimates of car space to be used. We oppose this experiment. It prescribes no method for measuring space actually used, no check-up of estimates by actual measurement, no way of proving whether the space authorized approximates that furnished. The computation of mail pay should be on a basis of ascertained facts so far as practicable, and all findings of the Post Office Department should be subject to review by some less interested arm of the government.

V—Federal regulation of railway security issues would be an advantage if it did away with regulation by states. Superadded to state supervision, it would further confuse and harass the roads in their financing, already made complex, cumbersome and slow by multiplicity of masters. Inasmuch as authorities differ as to what can ultimately be done, we advocate that federal action be confined to publicity, as recommended by the Hadley Commission.

VI—President Wilson by his sympathetic reception of railway executives and his generous response to their plea for public co-operation has shown that the time has come when political leaders are willing to listen without prejudice to appeals on behalf of the carriers. Members of our association can do effective work in arranging conferences with governors, state legislators and members of Congress. The more open and public such meetings are the better.

VII—We congratulate the people of Missouri on their veto of the extra crew bill. In most states railroad commissions have ample power to require safety precautions according to actual circumstances, which vary from time to time and from road to road. Details should be left to regulation. Needless men promote danger rather than safety, and their compulsory employment is a waste of money collected from the rate payers. In those states which have extra crew laws our association will advocate repeal.

VIII—America has lagged too long behind Europe in protecting against himself the person who risks life and limb by trespassing on the railroad right of way. Our laws are loose, our enforcement lax, the result a yearly toll of awful magnitude. We favor absolute prohibition of trespassing on railroad property under heavy penalties and rigid severity in dealing with offenders.

IMPORTANCE OF SAVING TIME.—The element of greatest expense in manufacturing is time, for a little time wasted here and there will lessen, and possibly destroy, the year's profits.—*American Machinist.*

Heat Treated and Alloy Steels for Locomotive Parts

Possibilities of Lighter Sections and Increased Fibre Stresses; Comparisons with High Grade Carbon Steel

The following is part of the discussion of a report on "Steam Locomotives of Today," presented before the railroad session of the annual meeting of the American Society of Mechanical Engineers, held in New York, December 2, 1914:

USE OF HIGH GRADE ALLOY STEEL TO REDUCE WEIGHT

C. D. Young, engineer of tests, Pennsylvania Railroad: With the ordinary annealed carbon steel as used generally for locomotive forgings, such as axles, crank pins, side rods, etc., the minimum physical properties may be considered to be as follows:

Tensile strength.....80,000 lb. per sq. in.
Elastic limit .....½ the tensile strength
Elongation in 2 in.....22 per cent
Reduction of area.....30 per cent

With properly quenched and tempered carbon steel we may expect an increase in the elastic limit of 30 per cent or more, about 15 per cent increase in tensile strength, the elongation remaining the same and the reduction of area increasing about 50 per cent. These are conservative figures and a great deal better elastic limit and tensile strength may be obtained, depending upon the chemical composition of the steel and the heat treatment.

From alloy steels, such as chrome-vanadium or chrome-nickel, we may expect to obtain the following minimum physical properties after heat treatment:

Tensile strength.....95,000 lb. per sq. in.
Elastic limit.....75,000 lb. per sq. in.
Elongation in 2 in.....20 per cent
Reduction of area.....30 per cent

On an average these alloy steels will show an increase in physical properties over those of annealed carbon steel of 20 per cent or more in tensile strength, 80 per cent or more in elastic limit, with elongation in 2 in. about 9 or 10 per cent less than that of the carbon steel, and the reduction of area 75 per cent or more greater. These figures are also subject to considerable variation on account of variation in the chemical composition of the steel and the heat treatment.

In carbon steel castings approximately the same per cent increases in physical properties as were given for carbon steel forgings may be obtained after proper heat treatment. The experience with alloy steel castings has been too limited to furnish any satisfactory data.

Up to the present the majority of users of heat treated steels seem to have made but little, if any, use of the increased physical properties as determining the fiber stresses used in design, though some of the larger builders of locomotives have made such increases in fiber stresses for both heat treated carbon and alloy steels. In certain parts where heat treated carbon steel has been used, the fiber stress has been increased about 25 per cent above that used for annealed carbon steel, and in the case of heat treated alloy steels an increase of as much as 50 per cent has been made. In some cases, depending upon the design and service for which the forging is intended, it is preferable to allow no increase in the fiber stress, but to consider the excess strength of the heat treated material as contributing to increased life in service, or to safety.

Parts	Grade of Material	Working Fiber Stress, Lb. per sq. in., in Tension or Compression	Working Fiber Stress, Lb. per sq. in., in Bending	Minimum Ultimate Tensile Strength	Minimum Elongation in 2 in.	
Main and parallel rods	Annealed .45 carbon	8,000	10,000	80,000	1,800,000 T. S.	20 per cent
	Quenched and tempered .52 carbon	10,000	14,000	85,000	2,000,000 T. S.	20 per cent
	Quenched and tempered alloy	12,000	18,000	100,000	..... T. S.	20 per cent
Piston rods	Annealed .45 carbon	9,000	.....	80,000	1,800,000 T. S.	20 per cent
	Quenched and tempered .52 carbon	10,000	.....	85,000	2,000,000 T. S.	20 per cent
	Quenched and tempered alloy	12,000	.....	100,000	..... T. S.	20 per cent
Driving axles	Annealed .45 carbon	Combined bending and torsion in starting	18,000	80,000	1,800,000 T. S.	20 per cent
	Quenched and tempered .52 carbon		20,000	85,000	2,000,000 T. S.	20 per cent
	Quenched and tempered alloy		25,000	100,000	..... T. S.	20 per cent
Crank pins	Annealed .45 carbon	.....	13,500	80,000	1,800,000 T. S.	20 per cent
	Quenched and tempered .52 carbon	.....	16,000	85,000	2,000,000 T. S.	20 per cent
	Quenched and tempered alloy	.....	20,000	100,000	..... T. S.	20 per cent
Cast steel parts	Annealed .28 carbon	8,000 (Tension)		60,000	1,400,000 T. S.	22 per cent
	Quenched and tempered .28 carbon	10,000 (Tension)		75,000	1,800,000 T. S.	20 per cent
				Transverse Strength		Bend Test
Springs	Drawn 1.0 carbon	70,000	.....	90,000		25 deg.
	Quenched and tempered 1.0 carbon	90,000	.....	120,000		25 deg.
	Quenched and tempered alloy	100,000	.....	150,000		50 deg.

Note.—Maximum figures for working fibre stress may be 20 per cent in excess of those shown.

Recent practice has indicated that it is desirable, when using heat treated designs, to carefully study the sections, so as to avoid abrupt changes, and also in the case of larger shafts, such as axles or crank pins, that they should be hollow bored in order to provide for better treatment and to relieve shrinkage strains which occur during the quenching process.

While there is no objection to the change of the present standard section, it would seem, with our present knowledge of heat treated material, that it would be entirely safe to use certain increases in the fiber stresses when designing the locomotive parts, and, as a suggestion as to what could be done in this respect, the accompanying table shows what is recommended for three grades of steel as to working fiber stresses and the minimum ultimate strength and elongation. This has been tabulated for the grades of .45 annealed carbon, quenched

and tempered .52 carbon, and quenched and tempered alloy steels.

Results seem to indicate that heat treated carbon and alloy steels will show greater resistance to wear and to the fatigue stresses in service than annealed carbon steel, and it is our opinion that the increase in resistance to wear is about in proportion to the increase in Brinell hardness, which is brought about by the heat treatment.

CARBON AND ALLOY STEELS

H. V. Wille, Baldwin Locomotive Works: The use of high grade alloy steels is at present largely confined to reduction of weight of the reciprocating parts in order to permit a corresponding increase in the dead weight on drivers. It is, however, undesirable to greatly reduce the sections and weight of rods, even though they may be made of alloy steels, for the reason that they are subject to failure by buckling and when loaded as a column under a compressive load will not show much superiority over a high grade carbon steel.

With many other railroad metallurgists, I do not consider that the possibilities of high grade carbon steel have been utilized to the fullest extent by designers. This is no doubt due to the fact that designers and metallurgists look at the properties of steel from entirely divergent views. The metallurgist wishes a steel of great ductility with a good elongation and reduction of area, or in other words, a steel that will readily flow under limiting loads, whereas the designer desires a stiff steel, one of high elastic ratio or a steel that will not readily flow under loads above the elastic limit. The metallurgist, therefore, specifies a steel with a high elongation and reduction of area and to meet these conditions the manufacturer is compelled to use a steel of medium carbon.

As for possibilities of improvements, a decided reduction in weight as well as the elimination of failures would result from a modification of existing specifications for forgings for the purpose of permitting the use of steel of high tensile strength and elastic limit, even at a sacrifice of the ductility as measured by the elongation and reduction of area. These views are sustained by the results of an elaborate series of tests conducted by the United States government at the Watertown Arsenal by Jas. E. Howard, on the endurance of rotating shafts. The enormous increase in endurance following the use of material having high elastic limit and tensile strength is notable in that a .66 carbon steel shaft exhibits as much endurance as 5.6 per cent nickel steel.

These figures carry an obvious lesson and one which is gradually being appreciated for its full worth, and it is in entire accordance with our past experience. When steel forgings were first proposed for use in locomotives a soft grade of steel was generally employed, the purpose being to secure a steel of properties similar to the iron formerly employed. The use of this material resulted in an unusual number of failures of axles, pins and rods, and after studying these failures, Dr. C. B. Dudley, S. M. Vauclain and S. T. Wellman experimented with higher carbon steels. This led to the general adoption of steel of 80,000 lb. tensile strength for locomotive work, with the result that the failures were eliminated and the great superiority of this steel over the softer steel was demonstrated, notwithstanding the great difference between the two steels in elongation and contraction of area. This grade of steel is still being universally employed and any changes were for the purpose of increasing the ductility requirements rather than the tensile requirements, thus handicapping the manufacturers in the development of this grade of steel. If specifications were revised to permit the use of a .65 carbon steel there would be but little necessity to employ the expensive alloy steels.

Machine Power and Piecework.—In any shop if the feeds, speeds and power of machine tools of the same class vary, it is a practical impossibility to establish a just and efficient piecework or premium system.—*American Machinist.*

POINTS FOR THE ROAD FOREMAN*

By W. P. Danforth

During ten years of service as road foreman of engines on one of the leading railroads located at a terminal which might be called the business center of the road, I was called upon to employ, examine, and promote an army of men. It gave me an insight into the general make up of this class of men; and, while I have occasionally found an obstinate one who wants his own way, most of the candidates sincerely desired to be known as good engineers.

From conversations with the engineers on the line on which I am employed, I find that the greatest factor in building up a class of men who will "deliver the goods" on a busy single-track line (one which has been reasonably free from distressing accidents) has been the pattern set by a long line of good clean, honest and successful men. *Example* is the most important item. I myself, in my youth, selected a noble man as my ideal, an engineer who became one of the ablest superintendents of motive power in the United States; and I derive greater satisfaction from my record as an engineer, than from the position of superintendent, which I now hold.

The engineer must be clean as a hound's tooth, and temperate in all things. He must cultivate the habit of having the greatest respect for the rules. I know of a young engineer who sidewiped a passenger train, before he learned to respect the rules that required him to stop a certain distance from a signal. He always wanted to get closer than the rules allowed. I warned him several times, and after the accident he acknowledged, that, had he followed my advice the collision would not have occurred.

An engineer must study and never allow himself to become rusty. We learn and soon forget, unless we keep everlastingly at it. The successful engineer will study his time-table and book of rules, at every opportunity, as a lawyer studies his law books. The study of speed and the distance required to stop under everyday conditions is of the greatest importance. I would suggest that every engineer post himself on the table of speed and distance required to stop, as given in the Westinghouse Air Brake Instruction Book. A slight increase in speed throws the distance in which we have to make the stop all out of proportion. There is an element in the service of all railroads who think locomotives, air brakes, cars and every thing else placed in their hands should be in perfect order at all times, and, if defects show up they are relieved of all responsibility. My advice to young engineers would be, shun this class of men; always strive to overcome the difficulties which may arise in your work.

Pooling engines and taking all the work off the engineer in the way of caring for the general upkeep of the engines has not been beneficial in developing in engineers those painstaking traits that make them successful. Filthy engines have a great deal to do in developing a slip-shod engineer. Neat surroundings have a tendency to make men more particular about their work. The painstaking, particular men rarely get into serious trouble; therefore surround the engineer with neatness. Note the difference between the cab of a locomotive and the engine room of an ocean liner.

Officers, especially those in the passenger department, who are always making extravagant promises in regard to schedules, should be as considerate as possible in their requirements for speed. In my experience as an engineer I never allowed this pressure to remove from my mind, for a second, the all-important subject of safety of the passengers riding on the train.

Harsh methods on the part of railway officers in an attempt to accomplish the impossible, that is to prevent all accidents, have

*This is the fifth of a series of articles, made up of useful hints to locomotive runners, which were written in connection with the prize competition of several months ago. The previous articles of this series were printed in the issues of September 25, October 2, November 27 and December 11.—Editor.

done much to increase accidents by putting something in the minds of runners, namely, the fear of losing their positions, which ought not to be there. Here again may be seen the importance of example. Officers must lead their men by example, by kindness and by firmness. The Brown system of discipline was a timely innovation. It brought in the element of humanity, and did more to develop a good class of men than carloads of the harsh methods which so widely prevail.

TRAIN ACCIDENTS IN NOVEMBER[1]

The following is a list of the most notable train accidents that occurred on the railways of the United States in the month of November, 1914:

Collisions

Date.	Road.	Place.	Kind of Accident.	Kind of train.	Kil'd.	Inj'd.
21.	New Orleans G. N.	Pool's Bluff.	bc.	.....	3	4
*24.	Southern	Alexandria.	rc.	F. & F.	1	0
27.	Vicksburg S. & P.	Mounds.	bc.	P. & P.	0	37
28.	Bangor & A.....	Crystal.	xc.	P. & F.	0	11
28.	Ches. & Ohio.....	Richmond.	rc.	P. & F.	0	1

Derailments

Date.	Road.	Place.	Cause of Derailm't.	Kind of train.	Kil'd.	Inj'd.
2.	Southern	Belleville.	.....	F.	1	3
†12.	Lehigh V.....	Mud Run.	unx	P.	2	6
*17.	Louisville & N.....	Goodlettsville.	b. rail	P.	0	6
19.	Louisville & N.....	Garland.	b. rail	P.	0	5
21.	Delaware & H.....	Waterford.	unx	P.	0	0
22.	Balt. & Ohio.....	Mendota.	b. spring	P.	0	11
27.	Chicago & Alton....	Clark, Mo.	unx	P.	0	27
29.	Central of Ga.....	Toomsboro	washout	P.	0	13

The collision at Pool's Bluff, La., on the night of the 21st was between a log train of the Great Southern Lumber Company and a motor car ordinarily used by the track repair forces, but in this case carrying 10 passengers. Three of these passengers were killed and four others were injured. It is said that a section foreman was using the motor car to carry passengers without authority. How the collision came to happen is not clearly explained, but there was smoke from forest fires which may have interfered with the view of the men on the motor car. Testimony before the coroner, however, indicated that there was gross carelessness in assuming that no train was due.

The trains in collision on the Southern Railway near Alexandria, Va., on the 24th were northbound freights, a train of the Chesapeake & Ohio running into the rear of one of the Southern Railway. The caboose of the leading train was wrecked and a brakeman, off duty, sleeping inside of it, was fatally injured; and the caboose was burnt up. The second train was running in disregard of the yard-limit rule.

The trains in collision at Mounds, La., on the 27th were westbound passenger No. 5 and eastbound passenger No. 12. Both locomotives were badly damaged and 34 passengers and 3 trainmen were injured, none very seriously. Mounds was the appointed meeting place for these trains, and it is said that the westbound train, No. 5, approached at uncontrollable speed and so failed to enter the side-track, where it should have gone to clear the eastbound train. The engineman of No. 5 had a perfect record of 20 years' service.

The trains in collision at Crystal, Me., on the night of the 28th were a northbound passenger and a freight train which was switching in the yard. Eleven passengers were injured. The freight was on the main line without right.

The trains in collision on the Chesapeake & Ohio at Richmond, Va., on the night of the 28th were westbound passenger No. 15 and an extra freight, the passenger running into the rear of the freight. One passenger was injured.

[1]Abbreviations and marks used in Accident List:
rc, Rear collision——bc, butting collision——xc, Other collisions——b, Broken——d, Defective——unf, Unforeseen obstruction——unx, Unexplained——derail, Open derailing switch——ms, Misplaced switch——acc. obst., Accidental obstruction——malice, Malicious obstruction of track, etc. ——boiler, Explosion of locomotive on road——fire, Cars burned while running——P. or Pass., Passenger train——F. or Ft., Freight train (including empty engines, work trains, etc.)——Asterisk, Wreck wholly or partly destroyed by fire——Dagger, One or more passengers killed.

The train derailed at Belleville, Ill., on the 2nd was an eastbound freight and the engine and seven cars were ditched. A trespasser was killed and the engineman and two other trainmen were injured.

The train derailed at Mud Run, Pa., on the morning of the 12th was an eastbound through passenger. The locomotive and seven cars were derailed, one of the coaches sliding down the embankment, but remaining upright. Two passengers were injured fatally, and six other persons, including the engineman and the fireman, less severely. The cause of the derailment has not been determined.

The train derailed at Goodlettsville, Tenn., on the 17th was southbound passenger No. 93 and two baggage cars and one coach were overturned. The engine and the rear car, which was a sleeping car, were not derailed. The baggage car caught fire, but the flames were soon extinguished. Four passengers and two trainmen were slightly injured. The wreck occurred at 2 a. m., and the cause was a broken rail.

The train derailed near Garland, Ala., on the 19th was northbound passenger No. 2. The engine and three baggage cars fell down a bank. Four passengers and an express messenger were injured. The derailment is believed to have been due to a broken rail.

The train derailed at Waterford, N. Y., on the 21st was westbound passenger No. 31 consisting of four cars and a locomotive, the locomotive moving backward, pulling the cars. While running at low speed the engine was derailed on the bridge over the Mohawk river. Both the tender and the engine ran off the rails and broke through the ties, but were held up by the floor system of the bridge and were not badly damaged. The bridge was damaged to the extent of about $4,500.

The train derailed at Mendota, W. Va., on the 22nd was northbound passenger No. 714. Eleven passengers were injured, none seriously. The tender was the first vehicle to leave the track. The cause of the derailment, which occurred on a curve, is reported as the fracture of one leaf of an elliptic spring of the forward tender truck.

The train derailed near Clark, Mo., on the 27th was eastbound passenger No. 22, and four coaches fell down a bank. Twenty-three passengers and four employees were injured. The train was running about 30 miles an hour. The cause of the derailment was not discovered.

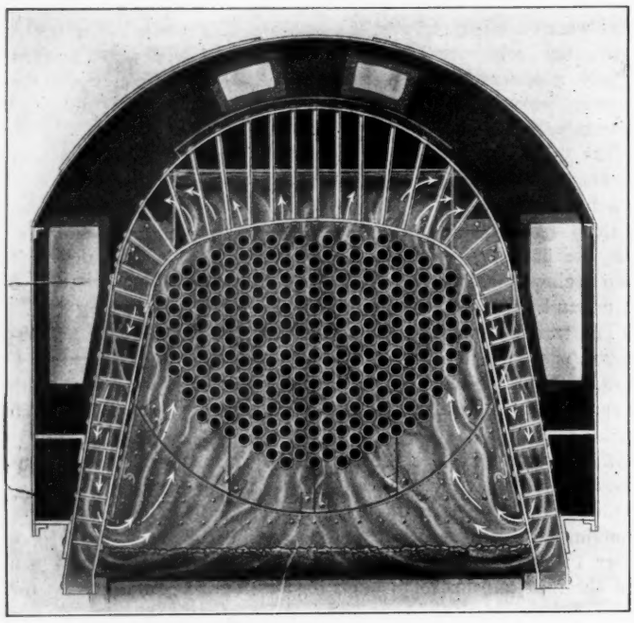
The train derailed near Toomsboro, Ga., on the night of the 29th was eastbound passenger No. 22, and one car was overturned. Eight passengers and five employees were slightly injured. The train was running about 20 miles an hour and the derailment was due to a washout caused by unusually heavy rains.

A SYSTEM OF WATER CIRCULATION FOR LOCOMOTIVE BOILERS

A device has recently been developed for the application of the Ross-Schofield system of circulation to locomotive boilers and is now in service on a number of locomotives. In this system, which has been successfully used in marine and stationary service for a number of years, the circulation is produced by utilizing the displacement of water caused by the formation of steam bubbles and their rise toward the surface. The water space above the hottest portions of the heating surface is enclosed by means of plates, communication with the body of the water space being provided at the top and bottom only. The generation of steam within the water column thus formed produces a rapid upward circulation of water which is properly directed by means of a guide at the surface.

The device for locomotive service is made up of three parts. A baffle plate which surrounds the tubes and separates the barrel of the boiler from the firebox portion, is secured to the shell of the boiler at the throat sheet. This extends to a height level with the highest point of the crown sheet, openings being provided at the sides below the center

line of the boiler. The space betwen the baffle plate and the firebox flue sheet is separated from the water legs at the sides of the firebox by side plates which extend downward to a point about 10 in. above the mud ring. A water column is thus formed which is enclosed by the flue sheet, the baffle



End Elevation Showing Direction of Currents from the Barrel of the Boiler

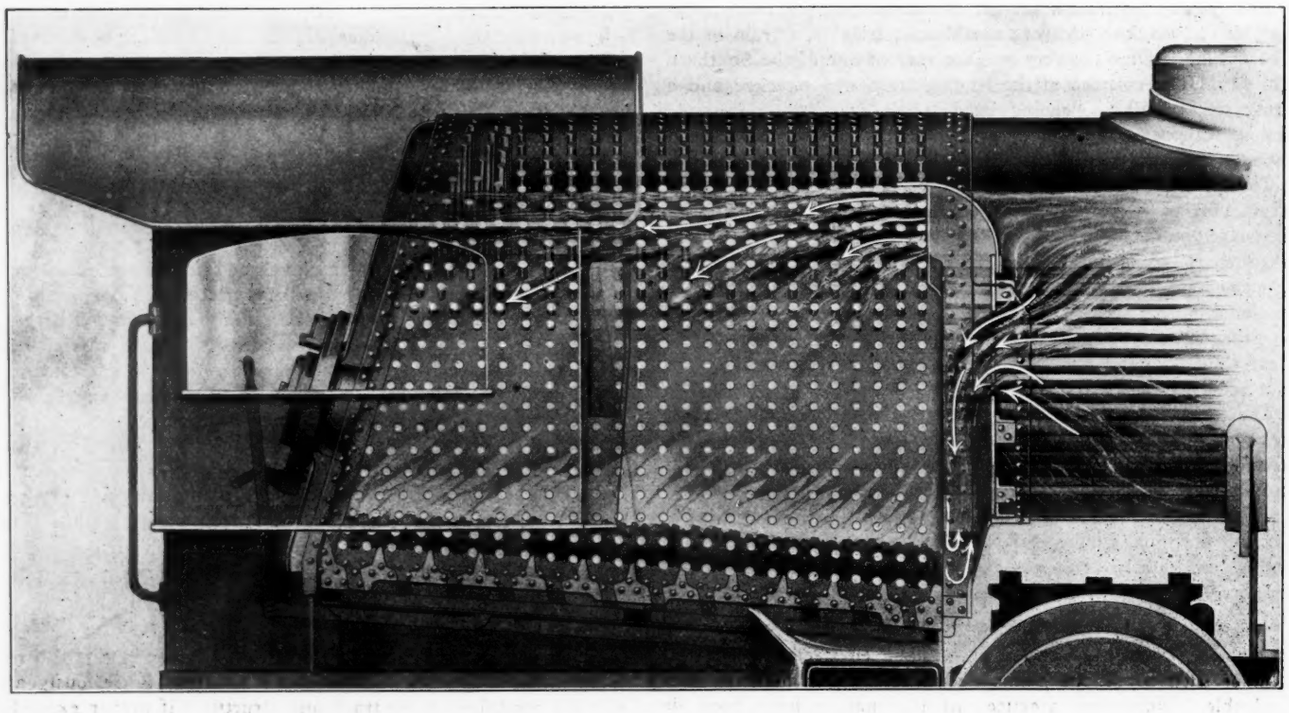
plate and the two side plates. All circulation from the barrel of the boiler must pass through the openings in the baffle plate, downward through the water leg to the bottom of the side plates and thence upward over the rear flue sheet and the rear ends of the tubes. Supported to the top of the baffle plate is a curved hood extending up to the normal water line, which directs the circulation over the crown sheet toward the back of the firebox. The water about the firebox thus moves in a circuit upward across the flue sheet, backward and downward along the crown sheets, side sheet and door sheet, and forward near the bottom of the water legs. As the water in the firebox space is evaporated more flows in from the barrel of the boiler through the openings in the baffle plate.

Among the advantages which are claimed for this device is increased rapidity of evaporation due to the constant freeing from the heating surface of the steam bubbles by the sweeping action of the water. Priming is overcome by means of the hood which directs the rush of the rising steam and water in a horizontal direction, thus making available the entire surface of the water over the crown sheet for the separation of steam with a consequent decrease in violence of ebullition at any one point. The rapid circulation of the water prevents the formation of stagnant pockets of cold water near the corners of the firebox and produces a uniform temperature at all points around the firebox, thus in a measure preventing the effects of unequal expansion and contraction of side sheets and staybolts. It is also claimed that the formation of scale is largely prevented by the rapidity of the circulation, the particles of scale-forming material collecting at the mud ring where they may be disposed of through the blow-off cock. This is borne out by experience with the system in stationary service.

This device, which is being introduced by the Q & C Company, 90 West street, New York, may be readily applied to boilers of existing locomotives whenever the tubes are removed for repairs. The baffle plates may be made in sections of any size suitable to be taken into the boiler through the dome, the parts being assembled inside the boiler before the tubes are applied.

Iron Exports from Sweden.—Iron ore heads the list of Sweden's exports. During 1913, 6,440,000 tons were exported to foreign countries, chiefly England and Germany.—*Machinery.*

Oxygen in Blast Furnace Practice.—If oxygen is added to the air-blast for a blast furnace, so that it is present to an extent of 23 per cent in the air instead of the normal 21 per cent, there is a saving of from 110 to 130 lb. in the amount of coke required to smelt a ton of iron, and the iron produced is said to be of a higher quality.—*Scientific American*



Direction of Currents Over the Crown Sheet, Ross-Schofield System of Circulation

Maintenance of Way Section

In accordance with our practice for the last three years, the maintenance of way section for January will be delayed one week in order to include a complete report of the eleventh annual convention of the American Wood Preservers' Association, which will be held in Chicago on January 19-21, 1915. This section will therefore appear in our issue of January 22 instead of January 15.

Protecting Concrete from Freezing

It was universally the practice a few years ago to discontinue concrete work at the approach of cold weather, and this is still generally the practice today. An increasing amount of such work is being carried on throughout the winter, however, as the means of protection of the green concrete from the cold are becoming more generally known. On the larger projects this subject is of sufficient importance to attract the proper amount of attention and insure reasonable precautions being taken. It is on the smaller railway work, which may be under the charge of a foreman of limited experience, that the common methods of protection are not always so well understood and greater risks are taken. It is therefore advisable for the supervisors of bridges and buildings to assure themselves that their foremen in charge of concrete work at this season of the year are thoroughly familiar with the common means of protection against the cold and the action of concrete under low temperatures. These methods are so simple and inexpensive that much work can be continued through the winter to advantage without injury to the finished work.

Unnecessary Physical Requirements

There is merit in the criticism of W. E. Schott, published in another column of this issue, regarding the physical standards set for section foremen. In view of the severe shortage of section foremen, it would appear questionable if in many cases physical standards are not emphasized to the neglect of other qualifications such as experience and ability. These standards were originally established for the examination of men in the train service where they were necessary. In too many instances they have since been extended to cover employees in other departments without proper modifications to meet the different and less severe conditions existing in those departments. As a case in point, a rodman was employed on a western road and hurriedly sent out to join an engineering party without opportunity to take the required physical examination. Two months later the company physician gave him the routine examination and found that he had only one good eye. The medical department immediately ordered the man discharged, although his work had been of such high grade that none of his associates knew of his defect. Such universal applications of standards in places where they are not necessary, work to the detriment of a road.

The Snow Problem

The most serious problem confronting the maintenance of way department for the next three months is that of keeping the tracks free from snow and ice in order to maintain uninterrupted service. Frequently little opportunity is afforded to prepare for severe storms and this work becomes of an emergency character. Under such conditions a knowledge of efficient methods is invaluable. Numerous practices of this nature have been described in our columns from time to time. In the January maintenance of way section we expect to present several descriptions of methods actually followed on different roads in preparing for winter conditions and in meeting them as they arise. We solicit other discussions of this subject from those who have had experience along this line. Such discussions should be confined to practical methods for anticipating winter conditions in advance through proper preparations the use of labor saving equipment in clearing the tracks, the organization of the forces and the proper means of caring for the men when working under extreme conditions. To be published in the January maintenance of way section, all contributions should be sent to the Engineering Editor before January 8.

THE PAST YEAR IN MAINTENANCE WORK

IN looking back over the year now closing the one feature which has characterized it from the standpoint of the maintenance of way department has been the severe retrenchment in expenditures. A comparison of these charges on 15 representative roads for the period from April 1 to September 30, inclusive, of this year, with the same period last year, shows a decrease of 10.5 per cent. As there are many items entering into maintenance of way work on which little or no retrenchment can be made, the reduction has been correspondingly greater on others. This has been especially marked with reference to the placing of new rail and ballast, and is indicated best by the fact that the steel mills have been working at very much reduced capacity during the entire season. As the traffic has not shown any marked decrease in amount, the wear on the rail now in track has been practically normal and any reduction in such items made during the past season means that they are only deferred until a later date.

The tendency toward the rolling of heavier rail sections up to 100 lb. has continued. One important eastern road has devoted extensive study to the design of a 125-lb. section which it proposes to make standard for future rolling. While this is not as heavy as the 135-lb. section used on one division of the Central Railroad of New Jersey, it is a marked advance over the weights commonly used.

Partially counteracting the retrenchment in expenditures has been the lower average wage rate for laborers. In contrast with recent years there has been an ample supply of labor throughout the season, and as a result it has been possible to secure considerably more work per dollar expended. Also the very general retardation of heavy improvement work has permitted the maintenance of way forces to concentrate their attention on their regular duties. Largely as a result of these conditions, the track as a whole is going into the winter in better shape than might otherwise be expected.

While the adoption of new materials has been generally retarded during the past year, their use has been extended on many roads. A notable example is that of the installation of 845 turnouts, with manganese frogs and guard rails throughout, at the Clearing yard, Chicago. There is also an increasing demand for labor-saving devices of all kinds.

While the more universal use of concrete in bridge and building work has been general for several years, it is meeting with a wide adoption for many small details of maintenance construction, such as fence and sign posts. Several roads have already made this form of construction standard, while an increasing number are using it experimentally.

While the past year has been one of rigid economy, the retrenchment in general has not been sufficient to seriously affect the condition of the track and structures if proper expenditures are made during the coming year. However, a period

such as we are now passing through cannot extend for any great length of time without being evidenced; and these facts become noticeable more quickly as the demands upon the track increase from year to year.

ECONOMICAL HANDLING OF MAINTENANCE OF WAY PAINTING

THE entire force of maintenance of way painters on a western road was discharged late in the fall last year, only the master painter being retained. He was then instructed to mix the paint for derails and switch targets which was sent out to be applied by the section foremen. On receipt of his consignment, one man thought it was too thick and thinned it with signal oil; another did not take the time to remove the sand from the derails; and the remainder of the foremen handled their work with about the same degree of efficiency. The net result was that all the brushes were ruined and had to be thrown away and most of the work was done again the following spring when the paint gangs were reorganized.

On account of the inexperience of the average section foreman as a painter and the natural tendency to postpone such "extra" work until there is nothing else to do, this road's experience is probably typical of the economy to be expected from the expedient of turning over small maintenance painting work to the section men. Even if the foremen could be instructed until they are competent to handle such work, under present conditions many maintenance men would oppose the plan on the ground that the proper maintenance of track should fully occupy the time of the section forces.

Another expedient frequently adopted, particularly for repair work and the priming coat on new work, is to have the paint applied by the carpenter gang. Under some circumstances this practice may be justified. When a repair job involves a small amount of painting and is located at a remote point the cost of sending a painter to handle it is out of proportion to the results secured. The priming coat on a new building should be applied as soon as possible after it is erected, and if the painter cannot reach such work at once it is better for one of the carpenters to apply it immediately than to allow the building to stand unpainted until it is convenient for a painter to reach it. In addition to the objections to having such work done by an inexperienced man, however, this system has the further disadvantage that no carpenter likes to paint and if there is any opportunity to slight the painting, he is likely to do it. The painting of the tops of girders, stringers, etc., by bridge carpenter gangs when relaying bridge ties is quite common, but this also is objectionable from the standpoint of preserving the steel, since the carpenters frequently apply the paint without proper cleaning, during unsuitable weather, or without proper brushing out.

It is important, then, for railway officers to consider whether true economy is not promoted in most cases by the employment of regular painting gangs for bridges, buildings and miscellaneous work under the maintenance of way department. The recent convention of the Maintenance of Way Master Painters' Association at Detroit passed a formal resolution after the reading of the paper on this subject, abstracted elsewhere in this issue, declaring it to be the sense of the meeting that the employment of incompetent painters is "wasteful and extravagant," and that it is the "truest economy to employ competent and trained mechanics for every class of bridge and building painting." The need for trained men is well emphasized by a study of the paper on Prevention of Paint Defects presented at the convention referred to. This particular discussion of what a competent man can accomplish in securing a lasting protective coating is suggestive as to the contrasting results that would be secured without such a man in charge.

As was brought out in the discussion following the first paper mentioned, a different class of workmen is needed on steel bridges from those employed in house painting. A house painter dislikes to "chip rust," and some experienced men who have never worked on steel "do not know black rust when they see it," as one speaker stated. A minor advantage of keeping the gangs separate is that the equipment for bridge and building painting differs considerably and a saving results if a steel gang is kept busy on steel all of the time and a building gang on buildings.

If it is granted that a force of skilled painters should be employed for the maintenance of way department, the question then arises as to how this force should be organized to be most effective. The methods in use differ considerably on various roads and the best system for a given road depends largely on the organization with which its other maintenance of way work is handled. The principal conflict of practice is between the divisional force and the general force. On some roads the stations, sign posts, wing fences, etc., are painted by a gang from some large terminal traveling over the entire road and following out a prearranged program. Such a gang can be large enough to make efficient organization possible among the members of the gang and the men can live in a car kept close to the work so that little or no time is lost in getting to and from the job. On the other hand, the local officers who are familiar with the relative needs of the buildings in their territory are able to direct the efforts of a force under their direction to better advantage and plans can be made and changed to suit conditions with much greater facility than is the case with a central force.

NEW BOOKS

Supplement to Manual of the American Railway Engineering Association, 1914. Size 6 in. by 9 in., 91 pages, illustrated, paper cover. Price $1.

In accordance with the rules for the publication of its manual, the American Railway Engineering Association has issued a third supplement to its 1911 manual. This presents concisely the amendments and addenda adopted at the annual convention in March, 1914. The entire manual will be republished in 1915.

Conventional Signs, for use on Railway Profiles, Right of Way and Track Maps and Structural Plans. Size 6 in. by 9 in., 27 pages, paper cover. Published by the American Railway Engineering Association, 900 South Michigan avenue, Chicago. Price $0.25 for single copies.

A pamphlet has just been issued containing the conventional signs for use on profiles, maps and plans, which have been adopted as standard from time to time by the American Railway Engineering Association. The occasion for the collection of these standard plates in a separate pamphlet is the specification made by the Interstate Commerce Commission, referring to maps and profiles to be used in connection with the valuation of railway property now under way, that the symbols shall be the standards recommended by the A. R. E. A. in so far as they are applicable. The magnitude of this work makes it very desirable that these signs should be available in convenient form, and in addition, the pamphlet should be found of considerable use in all drafting rooms.

Structural Design, Volume 2, Design of Simple Structures. By Horace R. Thayer, assistant professor of structural design, Carnegie Institute of Technology. Size 6 in. by 9 in., 495 pages, illustrated. Bound in cloth. Published by the D. Van Nostrand Company, New York. Price $4.

The author of this book has attempted to cover a very broad field both from a theoretical and a practical standpoint. He takes up in detail the design of plate girder bridges, steel viaducts and elevated railroads, simple riveted truss bridges, simple pin-connected bridges, steel mill buildings, high office buildings, miscellaneous buildings, standpipes and elevated tanks. The volume is the second of a series of three, the first of which treats of elementary mechanics, stresses and the mathematics on which they depend. The third volume, which is in preparation, will cover the design of advanced structures. While each of the last two volumes presupposes a knowledge of the subjects treated in the former volume, they are also prepared for independent use.

Letters to the Editor

MORE ABOUT WOOD PRESERVATIVES

PHILADLLPHIA, Pa.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

Almost every trade journal article nowadays starts with "The present European situation." Then follow details outlining the actual, possible, probable and unlikely effects on the particular material or industry. The Forest Products Laboratory early got on the firing line with an article and told those who did not know "How the Wood Treating Industry Can Avoid Possible Injury Resulting from the War." The article by Mr. Teesdale referred to (*Railway Age Gazette*, October 23, 1914), outlines some of the recognized preservatives and processes, and mentions others which have not been accepted. Its conclusions are based in part on laboratory or experimental service tests, and while it is not fair to say they are not practical, because the man who plans and experiments is the most practical of all, they do not help materially in the present contingency. In fact, it is very doubtful if any immediate provision can be made for supplying from domestic sources the creosote formerly imported from Europe. Edison is reported to have perfected a process and had in operation a plant for the production of synthetic carbolic acid 17 days after the foreign supply was cut off. Perhaps an Edison will arise in the coal tar industry, although the maintenance of an adequate creosote supply does not depend on the building of domestic plants for its production, but on commercial conditions affecting the market for pitch and other coal tar by-products.

It is suggested by Mr. Teesdale that two courses are open "to avoid the possible result of a great reduction in the amount of timber treated." These are:

(a) The uses of substitutes for creosote.

(b) Lighter treatments where creosote must be used.

As substitutes for coal tar creosote, zinc chloride, creosote-zinc chloride mixture, creosote-crude oil mixture, wood tar creosote, and sodium fluoride are mentioned. The refined tar-creosote solution used since 1908, and in 1912 to the extent of 14 per cent of all the creosote used for tie treatment, and of wide commercial possibilities, is not mentioned for reasons which will be discussed later. The important question is what the treating plant manager is going to do who has a six weeks' creosote supply on hand and half a million sap ties in the yard which will badly deteriorate before spring. Is he going to switch to zinc chloride or sodium fluoride, and is his decision going to be based on "petri dish" experiments? It is more likely that commercial factors of plant equipment, delivered cost of available preservatives, character and ultimate use of his timber, and service results from preservatives and processes, will determine his policy. Moreover, the very conditions which curtail the creosote supply change the economic factors of plant operation. Railroads must economize, commercial plants must curtail output to the reduced demand, operating costs must be cut down, and, in short, the whole industry put on a reduced emergency basis. Therefore, to some extent the shortage in creosote is met by a reduced demand by the industry.

Zinc chloride is given as "the best known preservative that could be substituted." Its efficiency in dry situations is fully demonstrated and the effect of leaching is probably not as great as generally supposed. Definite service tests on a commercial scale are needed in wet regions, and the authentic records now available should be compiled. Low initial cost leads to the use of zinc chloride in preference to creosote and not as a substitute for it under many conditions.

It is stated that "with the prices which have prevailed, the annual charge against creosoted crossties has been less than for ones treated with zinc chloride"; also that should the price of creosote increase, "the annual charge for ties treated with zinc chloride would become the lower." These deductions are drawn from the table of annual charges in Forest Service Bulletin No. 118 and are based on the use of tie plates. The annual charge on zinc treated ties is often lower than for creosoted ones, since the mechanical life is limited in either case, and the initial cost of creosote treatment is high. On the other hand, the table bases the annual charge for creosoted ties on 10 lb. of creosote per cu. ft., which is 20 to 50 per cent more than most of the railroads are using. The New York Central, Lackawanna, Lehigh Valley, Santa Fe, Pennsylvania and others of the larger systems use an empty cell treatment which would probably average only 5 to 7 lb. per cu. ft. The comparisons drawn from such average figures mean very little, and local service conditions must be used as a basis of accurate comparisons between zinc chloride and creosote.

The unquestioned merit of the zinc chloride-creosote mixtures is mentioned, and it is mildly suggested that the present situation can be partly relieved by an increased use of such mixtures. Reading further, however, we find that the laboratory tests indicate that less than half a pound (.343 and .140 lb.) of creosote per cu. ft. of wood is enough to prevent attack by wood destroying fungi, while .312 and .468 lb. of zinc chloride per cu. ft. prevented the growth of the two fungi experimented with. The theoretical apriori deductions from these tests are, that one pound of creosote per cu. ft. of wood gives over 100 per cent margin of safety, but that the usual ½ lb. of zinc chloride injected would leave less than 10 per cent margin of safety. While the value of theoretical tests as to the amounts of preservatives required is to be strongly questioned, posterior reasoning from the above leads to the conclusion that the 3 lb. of creosote usually injected with the zinc chloride mixture would in itself be more than sufficient to protect the wood against fungus attack, presuming, of course, that it is properly distributed. We therefore have recommendations for the increased use of a preservative mixture as generally recognized and widely used, followed by theoretical conclusions which indicate that either one of the preservatives, and particularly the creosote, will be sufficient if used alone.

Another mixture recommended is that of crude oil and coal tar creosote. This is based on the high toxic properties of a small amount of creosote, the crude oil being added for its bulk and waterproofing qualities. This seems such a simple solution to the whole problem that it is passing strange every one has not applied it, particularly since we are told that the treatment by a 10 per cent creosote and 90 per cent crude oil mixture of all the timber which was creosoted in 1913 would have left a surplus of over 30 million gallons of domestic oil, and made us entirely independent of foreign oil. The one slight drawback to this plan is that the crude oil with a high asphaltic base which is suitable for such a mixture is available only in Southern California and parts of Mexico, and the item of freight to eastern points is considered by most plant managers as not making for economy. Perhaps with the Panama Canal in operation, suitable crude oil may be generally available at reasonable cost. If this is such a practicable plan, however, it seems strange that the Santa Fe, with ample crude oil supplies on its own line, and after extensive experiments with crude oil alone and in mixture with creosote, should still continue the importation of more coal tar creosote than any road in the country, and when this supply was cut off, switched to zinc chloride at its largest plant.

"Further relief could also be had by utilizing creosote from water gas tar." The wood preserving industry has been waiting for years for definite proof that creosote from water gas tar will serve the same purpose as the coal tar product. Pend-

ing final decision, the former oil has been used both openly and surreptitiously, but its use is still felt to be experimental. Sections of piling treated with a very high boiling distillate of water gas tar are reported as showing "only slight evidence of attack" after nearly two years of immersion in the Gulf of Mexico; but these forest service tests in this particular case are absolutely without value, because the water gas tar creosote fraction used was not a commercial product. The industry is keen to know whether this oil will protect against marine borers, and it is hoped that other tests of real practical value will be made. Whatever the outcome, it should be remembered that the output of water gas tar creosote is limited and that the price is not so very much less than coal tar creosote.

Refined wood tar creosote and sodium fluoride are mentioned as possible substitutes for creosote. Their use in this country, however, has been very limited, and the results are not sufficiently conclusive to justify their adoption on a commercial scale.

The refined coal tar creosote mixture is not mentioned in the Forest Products Laboratory article, yet since 1908 nearly 25 million ties have been treated with a combination of creosote oil and refined coal tar, while practically all paving blocks have been treated with such a solution since 1907. During 1912 it was estimated that about 28 million gallons of coal tar creosote solution were used, which is about 40 per cent of the total creosote consumption for that year. To ignore such a general practice and not to recommend its further use in the present emergency, or at least to mention its existence, is to leave out one of the most promising means of making the available creosote meet the demands.

The American Railway Engineering Association has recognized the existence of this practice and recommends certain precautions to be followed in the use of the solution. The refined coal tar used in such a combination should not be considered an adulterant of creosote, because it is the mother liquor from which creosote is derived, and in itself carries a considerable percentage of high boiling creosote, composed of toxic or antiseptic compounds.

The principal objections advanced against the addition of refined coal tar is that the presence of free carbon or the high viscosity retard penetration. Those objections are largely done away with by the use of tar which is refined by filtration or mechanical methods, while it is now known that free carbon particles actually enter the wood—freely in aqueous solutions, less readily when suspended in oils—(The Preservative Treatment of Wood, Bailey, Forestry Quarterly, Vol. XI, No. 1; The Use of Refined Coal Tar in the Creosoting Industry, Von Schrenk and Kammerer, Bulletin 163, American Railway Engineering Association). Definite experiments have been made which clearly indicate that a solution of coal tar and creosote oil is essentially a heavier creosote, and that the two substances combine so that it is impossible to separate them by any physical or chemical process. The evaporation from such a solution is less than from straight creosote, and the toxic properties are certainly ample to prevent the growth of wood-destroying fungi. Furthermore, tests on different kinds of pine show that when properly applied, the penetration with the solution is at least as great as with domestic and foreign creosote (Von Schrenk, Bulletin 163, American Railway Engineering Association). Furthermore, in two cylinder charges of red oak ties given identical treatment, one with straight creosote and one with 20 per cent coal tar added, the absorption from the solution averaged higher than with the straight oil.

The Forest Products Laboratory presented at the American Wood Preservers' Association meeting in 1913 a report on "Some Tests to Determine the Effect Upon Absorption and Penetration by Mixing Tar with Creosote." On the face of it this report seemed to indicate that the addition of coal tar materially retarded penetration, but analysis of the tests and conclusions clearly indicated that the equipment was entirely inadequate, that the temperatures used were too low and the relation of temperature to viscosity and its consequent effect on penetration were practically ignored. It has since been ascertained, however, that at the usual working temperatures of 180 to 200 deg. F. in the creosoting cylinders, the viscosity of the mixture is practically the same as that of straight creosote. In discussing possible means of making our available creosote supply go further, the Forest Service has entirely ignored this whole important subject, and apparently for no other reason than that their own experiments with limited temperatures and inadequate equipment did not give favorable results. If their conclusions on the other creosote substitutes mentioned—crude oil and creosote, for example—were also confined to their own laboratory experiments, there would be little that they could say one way or the other about the materials described.

The question of lighter treatments where creosote must be used is dismissed with a seven-line paragraph which makes no recommendations. Theoretical conclusions are drawn for other preservatives and processes, so why should not the tests above referred to, which indicate that half a pound of creosote per cu. ft. will prevent decay, be applied in the case of the empty cell process? To the theory can be added definite service tests for limited periods. The efficiency of reduced injections depends mainly on the thorough penetration of all sapwood and other treatable portions of a stick with the reduced quantities of oil, and any empty cell process which will not do this is worthless. It can be done commercially, and all sap ties (loblolly pine) have been given a through and through penetration with less than 2 lb. of creosote per cu. ft. It would be a real solution of the emergency which various plants are facing if they could safely reduce the creosote injection from 6 or 8 lb. to 4 or less per cu. ft. Such a policy would at least double the amount of material which could be treated by the same amount of oil, and would, beyond argument, be preferable to using the same timber untreated.

Sap ties given such light treatment would no doubt give twice as long life as untreated, and the real problem for the operator is whether to stick to creosote and reduce the injection or change entirely to zinc chloride, or to a mixture. The mineral salt promises well, but its value has not been fully demonstrated in wet regions, while in addition there is the expense at some plants of putting in the equipment to handle zinc chloride. Most of the mixtures recommended do not reduce the amount of creosote required below that which could theoretically be used in a reduced empty cell treatment, but the oil mixture in most cases would be a guarantee of longer life through the waterproofing or toxic effects of the material added to the creosote.

It may be that the present crisis will be of short duration, and certainly the wood preserving industry is not going to be put out of business by the reduction in creosote imports. The curtailed demand for treated timber, the use of mixtures and substitutes, and light impregnation, will go far towards relieving the situation. Moreover, our imports are not entirely cut off, and since the British Admiralty has not requisitioned all of the available creosote, a limited amount of English oil promises to be available so long as the British fleet maintains control of the seas. Two cargoes were en route when the war broke out and were safely delivered, and four additional shipments have been made since, with prospects of two or more cargoes to come before the end of the present year.

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Maintenance of Way Master Painters' Convention

Abstract of the Papers and Discussions Presented at the Meeting Held November 17-19, at Detroit, Mich.

The Maintenance of Way Master Painters' Association held its eleventh annual convention at the Hotel Tuller, Detroit, Mich., on November 17-18-19, with about 100 members and guests in attendance. The secretary's report showed an increase in membership during the past year. The officers of this association were: President, C. H. Plummer (C. R. I. & P.), Topeka, Kan.; first vice-president, F. C. Rieboldt (C. M. & St. P.), Milwaukee, Wis.; second vice-president, E. R. Cope (P. L. W.), Bloomingdale, Ohio, and secretary-treasurer, T. I. Goodwin (C. R. I. & P.), Eldon, Mo.

F. C. Rieboldt (C. M. & St. P.) read a paper on glazing in which he favored the use of beaded sash instead of putty for engine house windows, and the practice of placing the curved surface of a pane of glass toward the outside. H. B. Wilson (B. & L. E.) favored laying glass in cold weather with the curved surface down, although he thought that in warm weather it would make no difference. J. T. Lewis (Wabash) objected to the use of brads with wire glass, saying that zinc points are better.

H. B. Wilson (B. & L. E.) discussed at length the types of staging used on his line. In general, one-inch manila fall lines are provided on heavy work, even when it is low. It is found difficult to make a tie with these lines when they are new, but they become pliable after a little use. On a 150-ft. drop the tension in a one-inch line will reduce the size to 7/8 in. For stack work 3/4-in. to 1/2-in. lines are used. The staging is 24 ft. long, made of Norway pine with ash for the rungs, the sides being 6 in. deep in the middle and 4 in. at ends. On viaducts with open floors, 1 1/2-in. hooks and a 1 1/2-in. steel sling are used to support the planks. This sling cannot be cut by malicious persons or damaged by objects falling from trains. Extra large hooks are provided in the blocks. A center fall line is used to handle the center of the plank and to strengthen it.

On under span work, where there is no chance of dropping staging through the deck, the ends of two light wire cables are clamped around two column posts and a plank is supported between them. This can be moved along as needed. On through plate girder bridges the staging is hung from large hooks over the tops of the girders. If the bridge is too wide for planks, steel cables are run across to carry them, although planks as long as 38 ft. are used. When there is a railing on the bridge, a set of angles is used which hang over the top of the railing.

F. C. Rieboldt (C. M. & St. P.) did not think that the use of one-inch rope for staging would be safe. A. B. Phelps (L. S. & M. S.) stated that on his road light chains with a grab hook on one end and a ring on the other are used, the plank being supported on two-inch gas pipe. Martin Kane (D. & H.) favored the use of 5/8-in. chains, and F. A. Higgins (L. S. & M. S.), W. H. Clark (C. & N. W.), and T. I. Goodwin (C. R. I. & P.), also reported the use of chains. Mr. Wilson objected to the use of chains on the ground that there is danger of weak links existing without being discovered.

A stereopticon lecture on Fire Retardant Paint was delivered by H. A. Gardner of the Institute of Industrial Research, Washington, D. C. He reported tests which are being made on the feasibility of painting woods that have been made fire retardant by treatment with salts such as zinc chloride or ammonium chloride. There is no indication as yet that such woods cannot be satisfactorily painted. Numerous tests are being made on the effects of various stains and paints on the fire resisting quality of shingles. Creosote stains, which are frequently used, are found to increase the flammability of the wood, while paints containing zinc, lead and iron oxide retard the burning very materially. Silicate of soda also retards burning but will not wear outdoors. Any good oil paint will resist fire and will wear well outdoors.

A paper on Test Paint on Water Tanks was read by Bert E. Darrow (A. T. & S. F.). He reported that as a member of a committee to test paint on the interior of steel water tanks he applied four kinds of paint, which had previously been used on the outside of tanks, to the interior of tanks filled with treated water. In one month the paint commenced to blister and at the end of four months it was entirely gone. He was of the opinion that no paint will stand in water treated with soda and lime. His company has discontinued the painting of the inside of tanks except the two top sheets. He recommended that tanks holding untreated water be given three coats of some good paint, the first coat to dry at least four days, the second coat two days and the third coat a week before the tank is filled with water.

A paper on Membranous Waterproofing was read by William B. Jenkins of the Billings-Chapin Company, Cleveland, Ohio.

Other topics discussed on the floor included, Priming and Patchwork Done by Carpenter Gangs; Making Estimates on Bridge Painting; The Economy of the Use of Putty on Roundhouse Windows; Sanitary Conditions Around Bunk Cars, and the Best Method of Enameling Woodwork.

In the closing business session a committee was appointed to investigate the practice of enginemen blowing off water treated with soda and lime on steel bridges, leaving the structures coated with a white substance resembling whitewash and severely injuring the paint. A new by-law was adopted by the association providing that no paper read before a convention or discussion made on the floor shall mention the name of manufacturers or brands of material. The same officers were re-elected for another year, and it was decided that the next convention should be held October 19-20-21, at St. Louis, Mo.

INTERIOR WALL FINISHES AND PAINTING OF CONCRETE

By W. R. Parker
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Of the interior wall finishes developed during the past ten years none quite equals in importance the flat finishes, which produce a coating that can be washed and scrubbed without injury. They can be applied over plaster, paper, wood, metal, burlap, canvas, cement or concrete. Different kinds of surfaces require different treatment in order to obtain the best results. Newly plastered or green cement walls, which are damp, and where free lime is still present on the surface, require a zinc sulphate wash. This zinc sulphate solution is prepared by dissolving about three pounds of zinc sulphate crystals in a gallon of water. The solution should be applied from 24 to 48 hours before the first coat of paint, thus allowing the surface to dry out as much as possible and also to obtain the full benefit of the neutralizing properties of the solution. All dirt and grease should be removed from the wall before painting. It is advisable to go over the surface with a stiff brush or broom in order to remove all loosely adhering particles.

Plastered cement walls, which are dry, and which have not been previously finished, make necessary the reduction of paint for the first coat in order to stop up the suction of the surface. Boiled linseed oil should be used as a reducer. The amount of reduction necessary will depend entirely upon the character of the surface to be painted, and will vary from one to two quarts of boiled linseed oil to the gallon of paint.

There are two distinct reasons for treating concrete surfaces, namely, to preserve the structure against forces which exert deteriorating influences, and to improve the appearance. Al-

though quite generally the greatest stress is placed upon the decorative properties, the fact remains that proper coatings impart protection which annually amounts to millions of dollars. Unfortunately, in obtaining the desired decoration, frequently at the lowest possible cost, the proper methods of application in order to insure the maximum protection are sadly neglected.

For the reason that lime has a saponifying action on oils, and furthermore in cognizance of the fact that all cement and concrete construction contains alkali in varying amounts, the first matter to consider is how to treat surfaces in order to either eliminate this material by neutralizing it, or in some manner to keep it from exerting its harmful influence on the vehicle portion of the paint which is to be applied. A treatment which has for its object the elimination of whatever free alkali is present on and near the surface in many instances proves injurious to the structure. The use of mineral acids, while neutralizing the lime, will detract from the life of concrete construction. Solutions of materials which change the lime to insoluble salts, which do not act on oils, have been suggested from time to time, and have been used with varying success. What is known as the Macnichol zinc sulphate treatment has proven very successful for the treatment of interior walls before applying prepared flat wall finishes or other coatings. It is very generally recommended, and its satisfactory character is based on the reaction which changes the free lime to the sulphate form, the latter possessing no saponifying action on the thinner of the paint which is subsequently applied. This treatment has given excellent results on walls which are free from permeation. On walls, however, through which moisture forces its way, the soluble salts present throughout are dissolved and brought to the surface, where they give rise to such undesirable conditions as staining, etc., and upon the evaporation of the moisture, efflorescence develops.

Up to the present time the most satisfactory results are obtained by the use of a thin, varnish-like mixture, specially adapted for the work. This filler, as it is more correctly called, is practically a wash which penetrates into the concrete and prevents whatever action alkali would have on the oil paint coats which are to follow. Capillarity is destroyed by the oxidized film, which forms upon drying. This makes the passage of moisture through the paint coat impossible, and therefore represents the greatest benefit derived from this treatment. It is possible to apply paints ordinarily used on wood over the filler with assurance of equally satisfactory results, the number of coats it is advisable to apply and the method of application being practically the same.

As is the case in other painting, one of the most important factors in connection with good service consists in the proper preparation of the surface to be coated and the correct application of the material. Before applying the filler, all dust and loosely adhering particles should be brushed away. Surfaces which have grease or oil adhering to them must be carefully washed with benzine, turpentine or benzol before applying the filler, or otherwise it cannot properly perform its functions, and the paint coat will break away in the form of "scaling," because of lack of penetration.

Because of the tendency that concrete has for holding moisture, it is not advisable to use water in cleaning surfaces, because any paint coat applied over surfaces containing moisture will most likely result in "peeling." Wherever possible, the surface to be coated should be allowed to stand from three to five weeks in order to give it time to dry out. The undesirable effects obtained by the presence of alkali in the concrete are also lessened when the surface is allowed to stand for some time.

When applying the "filler" care should be exercised not to obtain a varnish or gloss surface, as this will hinder the succeeding paint coat from obtaining the necessary penetration. If the surface to be treated is very hard and smooth, as is the case in cement finishes, it is frequently necessary to go over it thoroughly with a stiff wire brush, otherwise the penetration may not be sufficient to allow the paint coat to obtain a firm hold within the concrete. When properly applied the filler penetrates into the concrete, and when dry nothing would indicate its application but a slightly brightened appearance. Gloss should not be perceptible.

One of the most undesirable features connected with concrete floors is the continual "dusting" which is caused by the natural grinding action of wear on the surface. Wherever the floor is subjected to hard usage the "dust" may, besides becoming a source of irritation, prove injurious to health. The "dust" adheres so firmly to the surface of the untreated floors that it is impossible to remove it. Sweeping tends only to aggravate, to a certain extent, the tendency to "powder," as many small particles are loosened or torn away. The floor is made sanitary by painting, because it can be kept clean and free from dust and dirt. All opportunity for "powdering" is overcome by the thin film of paint, which, when properly applied, has a firm hold within the mass of concrete, and, besides eliminating the possibility of surface wear, makes an impervious coating which prevents the absorption of moisture.

In applying the paint two factors must be given careful attention. While the pigment is a requisite of considerable importance, the vehicle will, in almost every instance, determine the wearing properties. Floors are subject to hard usage and must stand severe strains. It is necessary therefore to use a material which will oxidize to a dry film and which will retain sufficient elasticity to withstand the strains to which it is exposed. Ordinary floor paints, which prove satisfactory when used over wood, give like results when used over a properly applied filler. The wear closely resembles that found on a wooden floor. The paint coat invariably possesses better bonds within the concrete and the service in many cases is superior to that obtained from the same paint applied on wood.

Natural wear will gradually make necessary the repainting of floors. It is not necessary to again apply a filler. One coat of paint brushed out well gives the best results. In preparing the surface for repainting no strong alkali should be used for cleaning, as it will not only act upon the paint, but if not thoroughly removed will also affect the following coat. It is advisable to go over the surface with warm water and soap and allow sufficient time to elapse for drying.

PAINTING DEFECTS, THEIR CAUSES AND PREVENTION

By G. W. Thompson
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So much has been written connecting painting defects with materials used, the writer proposes in this paper to show how paint defects may in many cases be corrected without radical change in the materials used. One cannot, of course, ignore the materials, but one can seek to find out to what extent such a defect may be the result of the condition of the surface painted, the proportioning of the materials, the application of these materials, the time allowed between coats, etc. No paint material is perfect, but if it is to be commercially judged in comparison with other paint materials, it should be judged at its best and not at its worst.

CHECKING AND ALLIGATORING

Checking and alligatoring consist in the development of fine interlacing lines on the surface of a paint. Lines embracing small areas are called checks, and large ones, alligatoring. These phenomena are closely related and are probably due to the same general cause.

The outer coats of varnish and paint always tend to shrink greatly in volume and to become progressively harder and more coherent, thus producing either of two possible effects. One is the rupturing of this outer coat with consequent alligatoring or checking; the other is that the outer coat becomes thinner without rupturing. Which of these effects occurs depends upon the under coat. If it is soft, the outer coat in oxidizing and shrinking will draw up and slip over it with consequent rupturing. If the under coat is sufficiently hard, the outer coat does not slip

over it and simply becomes thinner by shrinkage and no rupturing occurs. Alligatoring also occurs whenever a paint is applied over another paint that inherently will not dry hard, as in the case of a harder paint applied over an asphaltum or a yellow ochre paint. Very extreme examples of checking or alligatoring occur where a non-volatile mineral oil has been used in an under coat.

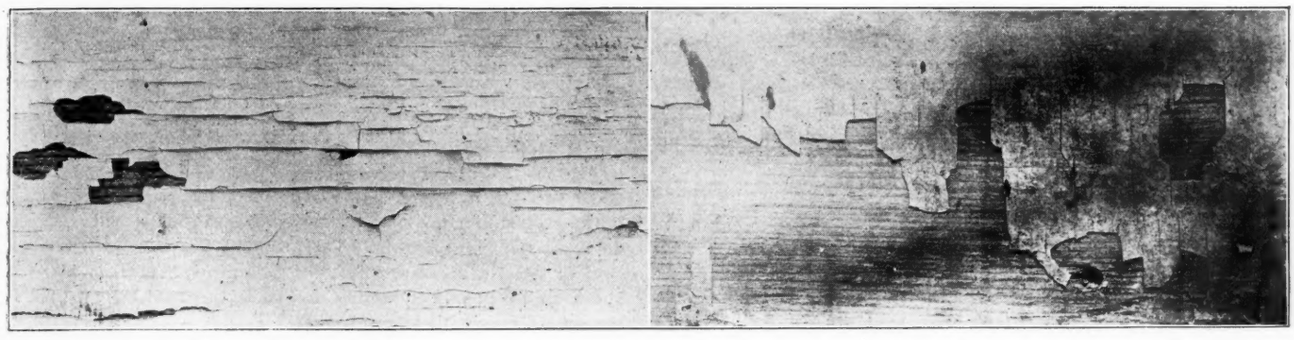
In order to avoid checking and alligatoring, it is best to have the under coats as hard as is practicable, much harder than the outer coats. It should not be assumed, however, that in all cases checking is an unmixed evil. In some cases checking may be the lesser of two evils, one of which is necessary. When a paint film has so great a tensile strength that it will not check, trouble is apt to ensue with the expansion and contraction of the foundation on which such a paint film is applied. If the foundation expands or contracts more than the film, the latter is sure to break loose, and the result is scaling. This would be a more serious defect than checking, and the competent painter must use his judgment in some cases to choose between the two.

It is important to point out that no materials should be used in the foundation coats which will not harden sufficiently or which cannot be made to harden by the addition of other materials. Such materials include all asphaltum, tar or bituminous materials, mineral oils which are not completely volatile, and such resinous products as resin oil, which harden too slowly to give good results. In all paints a drying oil is used. The drying oil should have in a high degree the power of being oxidized into a solid substance. Linseed oil is the principal material used by painters for this purpose, and the use of substitutes which are liable to be deficient in this respect should be carefully avoided. It is also important that those pigments which retard the drying or hardening of priming coats should not be used in excess. This refers particularly to lampblack and yellow ochre. On the other hand, pigments which assist in the drying and hardening of under coats should be used as far as is practicable.

Although drying oils are essential in paint for the prevention of checking and alligatoring, no more drying oil should be used in the foundation coats than is necessary for the filling in of the pores of the priming coat and the proper binding of the particles of pigment together in the body coat. By so doing two things are accomplished; one is that the natural hardness of the coating is increased by the increase in proportion of pigment, and the other is that, less oil being used, it takes less time to bring it to a fit condition for the reception of the other coats. Probably the most important thing to do in the avoidance of checking and alligatoring is to allow as much time as possible between the coats.

CRACKING AND SCALING

It would appear that cracking and scaling are closely related, that is, that in many cases scaling naturally follows cracking.

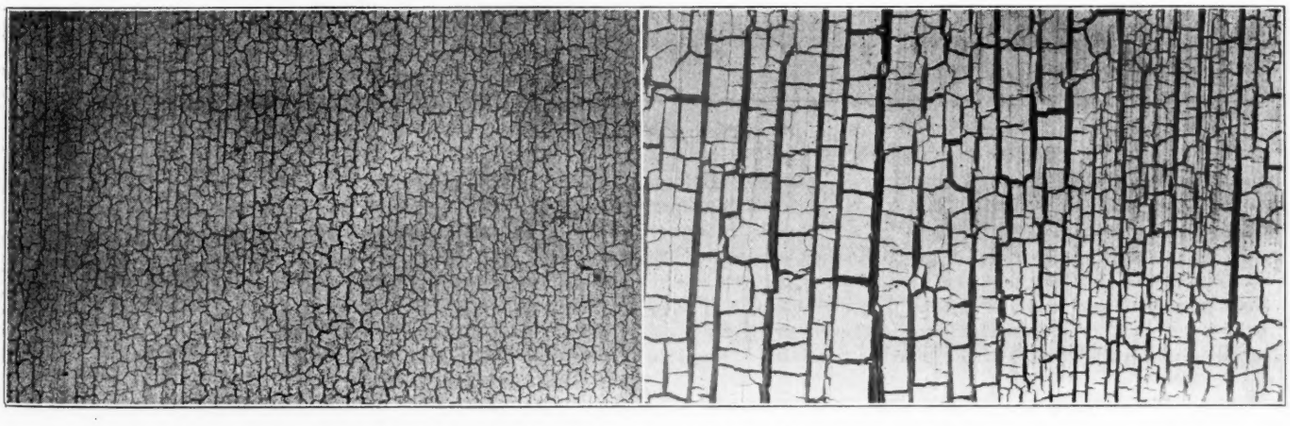


Longitudinal and Transverse Cracking with Consequent Scaling

By cracking we refer to the formation of hair-like lines on the surface, which an examination shows extend from the surface practically through the paint layer down to the foundation. In this respect cracking differs from checking or alligatoring. The areas included by the cracks are usually relatively large, although not necessarily so.

In case the painted object is wood, the cracks may be at right angles to or parallel with the grain of the wood. Wood is porous, containing at all times more or less free moisture. It has been found experimentally that in the drying out of wood, the greatest contraction takes place at right angles to the grain. The structure of wood is largely fibrous, the fibres running mostly with the grain. Free water or moisture in the wood is probably located between the fibres. This water forces the fibres apart. As the water dries out, the fibres come closer together, producing contraction across the grain. It would appear also that the variation of the amount of water in wood shows very little tendency to affect the length of the fibres, and so produce contraction and expansion parallel with the grain.

At the same time the paint contracts both across and with the grain. Consequently if the paint contracts less than the wood



Typical Checking and Alligatoring Caused by the Use of Ochre Priming

there will be a bulging and cracking of the paint with the grain. The contraction of the paint with the grain will not be compensated by a similar contraction of the wood, and cracks may appear, the lines of the cracking showing across the grain.

Cracks, as we have referred to them, extend down to the wood. As soon as cracks occur, there is an opportunity for moisture to enter the wood. This moisture, entering by the cracks, travels under the paint film, exerts a pressure against the paint film, the bond between the paint film and the wood is weakened, and scaling results. It seems to the writer that there is a difference between peeling and scaling. Both are due to moisture forcing the paint film away from the wood. Peeling, however, is due to the presence of moisture under an unbroken paint film in the wood or back of the wood, which forces the paint away from the wood. But in the case of scaling the moisture enters through the cracks.

It is to be noted that as a rule cracking and scaling take place most often when the paint film is thick. The thicker the paint film, the greater its tensile strength, therefore it does not conform as readily to the changes in the shape of the wood. One method of prevention is to avoid the accumulation of paint coats upon a surface. If the surface needs repainting, as much of the old paint should be sandpapered off as is necessary, provided, of course, it is too thick, and the new coats of paint applied should be comparatively thin. This refers particularly to paints which are naturally inclined to crack and scale. It is obvious, of course, that those pigments which give hard, strong and contracting coats, should be used only in moderation. Cracking and scaling can be avoided to some extent by having the wood thoroughly dry and contracted before painting.

BLISTERING AND PEELING

Blistering and peeling are due to the water in wood forcing its way through the wood to the surface, breaking the bond of the paint and forcing it away from the surface. Blistering is very apt to occur where moist painted wood is subjected to heat such as the heat of a radiator. Sometimes the heat of the sun is sufficient to increase the vapor pressure of the water enough to produce blistering.

Blistering and peeling are more apt to occur if a very impermeable paint is used. Painters sometimes complain that boiled linseed oil gives a more impermeable paint. The one safe method of preventing blistering is to remove the cause, that is, the moisture in or back of the wood. If one is in doubt as to the condition of wood for painting, the best practice is to allow considerable time after the priming coat has been put on before applying the body coat.

LOSS OF GLOSS AND CHALKING.

Chalking follows loss of gloss and is probably produced by the same general cause. Gloss is due to an excess of oil or binding material, which, lying over the particles of pigment, gives a smooth, even, glass-like surface. The binding material in paints, whether it is linseed oil or varnish, is an organic substance which is subject to fairly rapid destruction when exposed to the influence of air, moisture and sunlight. Loss of gloss is due to this destruction, and it would appear that the chalking of paint is but a step further in this destructive action, whereby the binding material is destroyed, and the pigment becomes loosened on the surface.

Chalking is objectionable principally because of the tendency of the pigment to come off when touched. It must not be overlooked, however, that some kind of paint decay is inevitable and a certain amount of chalking, that is, loss in thickness of coating, is therefore the least objectionable form of decay. If this loss in thickness does not occur, the result on continued repainting will be the production of so thick a coat of paint that scaling is apt to follow. Chalking, as it ordinarily occurs, has a further redeeming quality in that it nearly always leaves on the surface a roughness, usually called a tooth, which is favorable to repainting.

For the prevention of chalking and loss of gloss, it is evident that what is desired is a vehicle which can be used on the surface of paints that will be less destructible than what is ordinarily used. I regret that there is no such material that can be unqualifiedly recommended. Therefore, if chalking is a defect, it is not an unmitigated evil, nor is it one that can readily be avoided without other more serious defects arising.

WASHING

The washing of paint is characterized by the surface of the paint giving up certain water soluble substances. Apparently washing takes place when a paint contains such substances, or when they are formed either through a reaction of the constituents of the air upon the pigment or a reaction between the pigment and the binding material. For the prevention of washing, omitting any reference to the avoidance of the use of those pigments most inclined to wash, the only thing that I can say is what I have already said in the case of chalking.

SPOTTING AND DISCOLORATION

In the spotting of paint, the following characteristics are noted. The spots, which may be small or large, are much lighter in color than the remainder of the paint. Such spots show greater chalking than the body of the paint. Moistened with linseed oil, the spots return to practically the original color of the paint, indicating that there has been no destruction of the tinting material, and indicating also that at these spots there had been some excessive destruction or loss of the oil which was originally present.

The most common cause of spotting is that the wood at the points where spotting occurs was not completely filled by the priming or body coats. It is to be avoided then by the proper filling of the pores of the wood, and by allowing sufficient time between coats for weaknesses to develop that can be corrected by subsequent coats. It will be avoided to some extent by the competent workman using a stiff brush for the under coats, thereby forcing the paint into the wood.

There are two known causes of yellowing of paint out-of-doors. One is the presence of heavy mineral oil, and the other is the presence of alkalies or alkaline materials. The prevention of such discoloration depends on the avoidance of such materials. The cause of the yellowing of paint indoors is variously explained, but the one explanation which seems most satisfactory is that it is caused by ammonia which is more or less present in the atmosphere. The prevention of this yellowing is to have good ventilation, good light, avoid the presence of excessive quantities of ammonia in the atmosphere, and protect the paint as far as practicable by varnish coatings wherever such a treatment is necessary.

Discoloration of paint due to dirt is a defect for which the painter sometimes feels he is not to blame. There still remains the fact, however, that paint will sometimes become dirty more rapidly than exterior conditions would seem to warrant. The conditions favorable to dirt becoming attached to paint are softness and elasticity, which the painter naturally thinks are the best for the paint. The obvious method for the prevention of this discoloration of paint is the use of harder coats, obtained either by cutting down the amount of oil in the paint, or by the use of those pigments which tend to harden the paint. If, however, the painter secures hard coats of paint to prevent discoloration, he may run into the trouble of cracking and scaling.

Discoloration of paint on account of mildew is rather uncommon in the North, but is fairly common in the South. Experiments indicate that it is killed by the presence of very small quantities of mercury compounds and can therefore be prevented by a minute percentage of mercurous chloride added to the paint. It is also prevented to some extent by the use of paint which forms a hard coating and by the use of the best quality of linseed oil.

Discoloration due to the presence of sulphur compounds

occurs with those paints containing lead pigments. Sometimes this discoloration is due to the intentional or accidental presence in a paint of small amounts of sulphides of the other metals, particularly sulphide of zinc, which may be contained in lithopone to the extent of 30 per cent. The discoloration of lead compounds due to sulphur compounds in the air is not common.

THE ECONOMY OF SKILLED MECHANICS

BY EDWARD HURST BROWN
The Painters' Magazine

It might seem strange to a master painter that any question should be raised as to the economy of skilled mechanics if he did not know from every day experience that a large proportion of railroad officers either overlook the fact or do not realize that it requires skill to properly apply paint to obtain its full protective value and the greatest possible durability.

Too many engineers pay particular attention to the quality of the paint and little or none to the skill of the painter. This is a very mistaken notion, for the good mechanic will produce a reasonably satisfactory job of painting with poor materials, while the poor mechanic or the "handy man" will produce unsatisfactory results with the very best materials. It has often been said that satisfactory results in painting depend on "25 per cent material and 75 per cent man," and this does not over state the case. Some engineers admit that the good mechanic may be necessary in painting a station or varnishing the hardwood finish of a waiting room, but seem to believe that any men you can pick up are good enough to do bridge painting or other rough work. It is possible that there may be certain classes of rough work, such as whitewashing sheds, that need so little skill that the "handy man" can be utilized to advantage, though even in such cases, I believe that the man who has been trained to use his brush can accomplish so much more work that it is economical to employ him.

When it comes to painting structural iron or steel, there can be no greater mistake than the employment of cheap labor. An examination of the painting done on a bridge by a crew of "slushers" will show runs, sags, "holidays," and spots of rust that soon begin to show, because these so-called painters have not been impressed with the necessity for the removal of every particle of rust before the paint is applied.

The difficulty in getting satisfactory shop painting is explained largely by the fact that the work is often done by cheap, foreign laborers who have never been taught to handle a brush and whose only thought is to smear over the surface in the easiest possible way. They are too ignorant to understand anything about the real mission of the paint they are applying and so long as they cover up the metal with a red wash they are satisfied. The worst feature of painting of this kind, done over rust and shop scale, is that it affords no satisfactory foundation for subsequent paint coats, no matter how carefully they may be applied, and the protective value of the paint is minimized by the mistaken economy of employing cheap and unskilled laborers to put on the shop or priming coat.

An engineer may be told that paint needs to be tempered to suit the temperature, the weather conditions and the surface to which it is to be applied, but the idea that such tempering—a variation in the proportion of turpentine or other volatile thinners or the quantity of driers to be employed—can be safely left to the practical mechanic who is working on the job seems to be beyond his comprehension, especially when the paint has been made in accordance with a formula furnished by the company's chemist. Nevertheless, it is a fact that the skilled painter is better able to determine the proportion of thinners and of driers than the chemist who has never had any experience in actual paint mixing, or who has never learned to handle a brush. The practical painter, by long experience, has learned to judge by the feel of the paint as it spreads out under the brush; he has learned to judge the weather and to make allowances for a greater or less amount of moisture, or to vary his paint to suit the temperature. A skilled mechanic can paint in zero weather, so long as the surface is free from frost and is dry, and he will obtain as durable and satisfactory a job as he could produce in warm weather, for he will know enough to add turpentine to make the paint flow out more freely and to correct the thickening tendency of the cold weather, while at the same time he will depend upon "elbow grease" brushing out the paint into thin coats, rather than upon an excess of driers, to produce a firm and solid paint coating.

Painting requires more technical skill than almost any other trade, yet this fact is not recognized because of the mistaken idea fostered by the advertisements of the makers of household paints that "any one can paint." In these days when efficiency is the aim in all departments of a railroad, it would be well if the officers would recognize that only by the employment of skilled mechanics can satisfactory, durable and economical painting be done. They must remember that there is a dearth of skilled painters in this country today, and they cannot expect to hire them for the same wages that they can obtain unskilled labor, but the skilled painter can accomplish so much more work in a day and the value of the work he does will be so much greater in protective efficiency that the higher wage rate will be the most economical in the end.

COMPUTATION OF CROSS SECTION AREAS

In view of the large amount of cross sectioning of roadbed that is required in the federal valuation of railways, now under way, the method which is being used on the San Pedro, Los Angeles & Salt Lake for computing these areas in accordance with the standard method of recording notes in use by the Federal Board may be of interest to other engineers. The government parties take their notes as shown on the accompanying plan with the 0.0 points at the shoulders, showing the side heights at the toe of slope and the distance out. Referring to the sketch, the area of the section is equal to $\frac{(C+B)\,H+(D+A)\,H_1}{2}$.

A is equal to B when the roadbed is of uniform width on both sides of the center line. As an example, when the roadbed

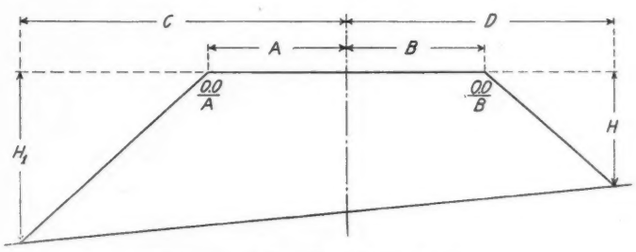


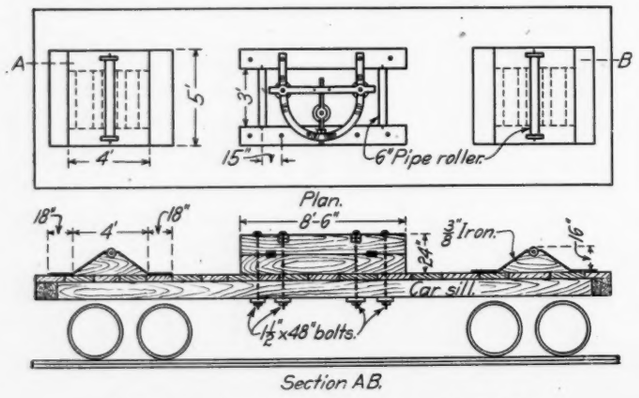
Diagram of Roadbed Cross Section

width is 18 ft., 9 ft. on each side of the center line of track; when H is equal to 4 ft.; H_1, 6 ft.; C, 18 ft.; and D, 15 ft.; the area is equal to $\frac{(18+9)\,4+(15+9)\,6}{2}$ which is equivalent to $\frac{27\times 4+24\times 6}{2}$ or 126 sq. ft. This method is applicable to prisms in cuts and fills for any widths of roadbed on either side of the center line. Our attention was called to the above method by M. E. Thompson, assistant engineer, and Arthur Maguire, chief engineer, of the Salt Lake line.

CURVING RAIL WITH POWER BENDER

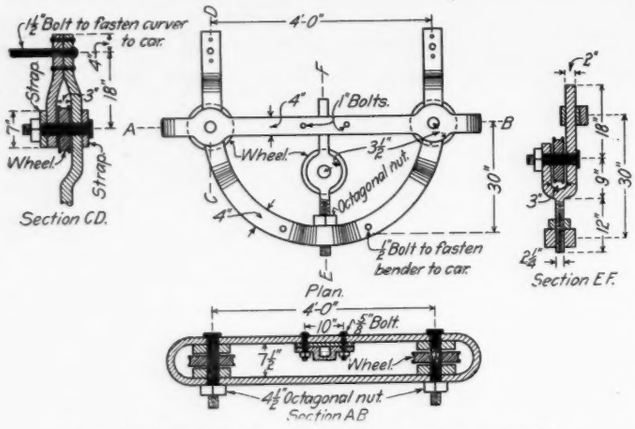
The Baltimore & Ohio uses a power bender whenever it is necessary to curve a large number of rails, although on this road curves up to 4 deg. are laid with straight rails. The curver is mounted on a flat car and the rails are pulled through it from another flat car to a car on which they are stored or from which they are distributed on the ground for laying. Either a locomotive or a hoisting engine mounted on another car can be used for the power.

The curver is of the common type, consisting of a semi-circular steel yoke, a strap connecting the jaws of the yoke



Method of Mounting Rail Curver on a Flat Car

and a plunger between the yoke and the strap, the position of which can be regulated by a threaded end passing through the yoke and a nut abutting against the yoke. The curving is produced by the three wheels, two of which are located at the intersections of the strap and the yoke, and the third is carried by the plunger. The rails are pulled between these wheels, the amount of curve produced being regulated by the position of the plunger. The jaws of the yoke are 4 ft. apart, and the wheels are 10 in. in diameter. The curver is mounted on two 12-in. by 12-in. timbers and is securely fastened to the flat car body through these timbers by 1½-in. bolts. The rails are



Details of Rail Curver Used on the Baltimore & Ohio

guided through the curver by 6-in. pipe rollers, mounted one on each side of the curver and one near each end of the car, the elevation of these rollers being so adjusted that the rail will enter the wheels of the curver properly.

It has been found that with this machine and an engine, operated by eight men and a foreman, 20 rails can be curved per hour, or 200 a day, at an expense of about $40 or $0.20 for a 33-ft. rail. Flat cars are ordinarily used, although the same method of operation would be possible with drop-end gondolas or stock cars. If it was necessary to curve a great deal of rail, it would be more economical to use a platform with a hoist to unload and load the rails and a hoisting engine with three drums and cables to pull the rails through the curver. It is thought that with this equipment the cost could be reduced to $0.10 a rail. The principal difficulty that has been experienced is to get a hook small enough and at the same time strong enough to pull the end of the rail through the rollers at the start.

When curving large quantities of rail, continuous operation with this machine would be possible by using a gondola car in which the straight rail is shipped, a short car with an air unloader, an empty flat car, a flat car on which the curver is mounted, another empty flat car and a flat car on which a hoisting engine is mounted. The locomotive could be placed on either end. With this outfit the air unloader could pick up a rail from the gondola, and swing it around to the empty flat car; the hoisting engine could then pull it through the curver to the other empty flat car, from which it could be unloaded on the track. By providing a trough or slide of channel iron along this empty flat car, the rails could be unloaded easily and safely by throwing the hoisting cable over a pulley on the corner of the car on which the hoisting engine is mounted so that the rail would be pulled out by the cable with a little assistance with a bar.

BRIDGE AND BUILDING ASSOCIATION COMMITTEE APPOINTMENTS

The following committees have been appointed by the president of the American Railway Bridge & Building Association for the coming year:

Conditions Under Which Pile and Timber Trestle Bridges Should Be Repaired, Reinforced, Renewed or Replaced. A. B. McVay, chairman (L. & N.), Evansville, Ind.; C. E. Smith (M. P.), St. Louis, Mo.; F. G. Jonah (St. L. & S. F.), St. Louis, Mo.; S. T. Corey (C. R. I. & P.), Chicago; J. J. Taylor (K. C. S.), Texarkana, Tex.; E. J. Auge (C. M. & St. P.), Wells, Minn.; A. J. James (A. T. & S. F.), Topeka, Kan., and S. C. Tanner (B. & O.), Baltimore, Md.

Railway Water Tanks. C. R. Knowles, chairman (I. C.), Chicago; A. A. Wolf (C. M. & St. P.), Milwaukee, Wis.; O. M. Suter (I. C.), Chicago; T. J. Stuart (W. P.), Elko, Nev.; Jas. Dupree (C. T. H. & S. E.), Chicago; A. C. Sydell (C. B. & Q.), Chicago, and F. M. Case (C. & N. W.), Belle Plaine, Ia.

Coaling Stations. Lee Jutton, chairman (C. & N. W.), Madison, Wis.; W. T. Krausch (C. B. & Q.), Chicago; Grosvenor Aldrich (N. Y. N. H. & H.), Boston, Mass.; B. F. Pickering (B. & M.), Salem, Mass.; J. L. Talbott (A. T. & S. F.), Pueblo, Col.; A. W. Pauba (Colo. & So.), Denver, Col.; G. A. Manthey (M. St. P. & S. S. M.), Minneapolis, Minn., and William Mahan (W. & L. E.), Canton, Ohio.

Costs of Structures. G. A. Rodman, chairman (N. Y. N. H. & H.), New Haven, Conn.; F. E. Weise (C. M. & St. P.), Chicago; J. H. Nuelle (N. Y. O. & W.), Middletown, N. Y.; J. S. Robinson (C. & N. W.), Chicago; R. C. Sattley (C. R. I. & P.), Chicago; C. W. Wright (L. I.), Jamaica, N. Y., and W. A. Pettis (N. Y. C. & H. R.), Rochester, N. Y.

Efficient Methods of Handling Work and Men. G. W. Rear, chairman (S. P.), San Francisco, Cal.; J. F. Pinson (C. M. & St. P.), Seattle, Wash.; E. R. Wenner (L. V.), Ashley, Pa.; C. R. Knowles (I. C.), Chicago; R. H. Reid (L. S. & M. S.), Cleveland, Ohio; H. A. Horning (M. C.), Jackson, Mich., and S. C. Tanner (B. & O.), Baltimore, Md.

Warnings for Overhead and Side Obstructions. E. G. Storck, chairman (P. & R.), Philadelphia, Pa.; M. M. Barton (P. R. R.), West Philadelphia, Pa.; F. E. Schall (L. V.), South Bethlehem, Pa.; T. E. Thomas (B. & O.), Wilmington, Del., and E. S. Meloy (C. M. & St. P.), Chicago.

Reinforced Concrete Bridge Work. O. F. Dalstrom, chairman (C. & N. W.), Chicago; I. L. Simmons (C. R. I. & P.), Chicago; J. A. Bohland (G. N.), St. Paul, Minn.; C. J. Scribner (C. B. & Q.), Chicago; D. C. Zook (P. L. W. of P.), Ft. Wayne, Ind., and T. J. Stuart (W. P.), Elko, Nev.

Station Buildings for Passenger Service. M. A. Long, chairman (B. & O.), Baltimore, Md.; E. B. Ashby (L. V.), New York City; G. W. Andrews (B. & O.), Baltimore, Md.; K. Peabody (N. Y. C. & H. R.), New York City; R. McKibben (P. R. R.), Altoona, Pa., and W. T. Krausch (C. B. & Q.), Chicago.

Concrete Culvert Pipe and Concrete Piles. H. Rettinghouse, chairman (C. St. P. M. & O.), St. Paul, Minn.; S. T. Corey (C. R. I. & P.), Chicago; G. H. Stewart (B. R. & P.), East Salamanca, N. Y., and C. F. Urbutt (C. M. & St. P.), Chicago.

TUNNEL LINING BY COMPRESSED AIR

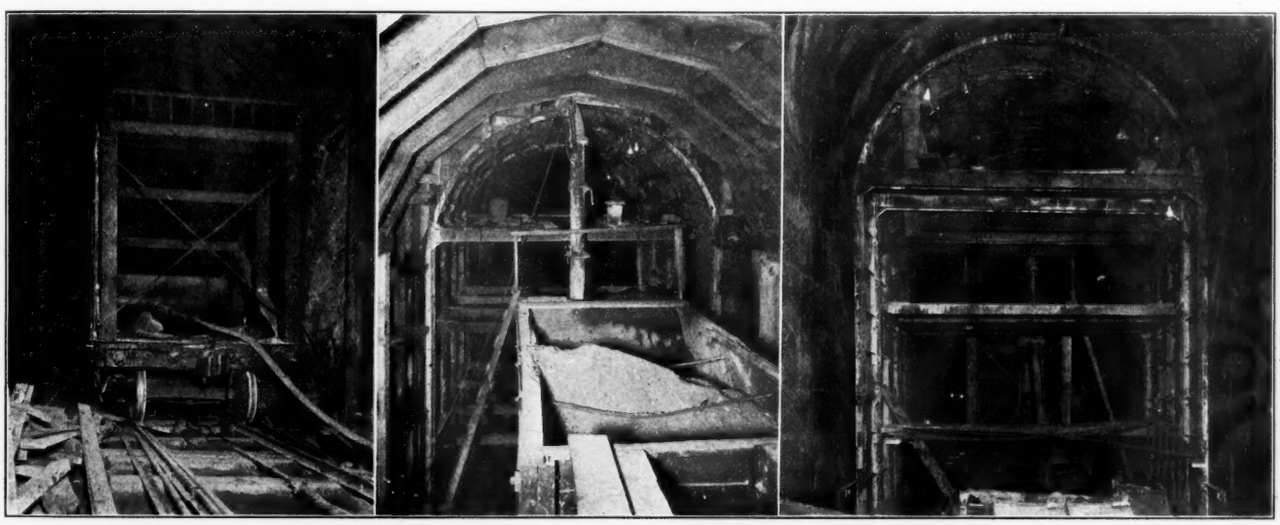
The compressed air method of mixing and placing concrete which was described in the *Railway Age Gazette* of March 18, 1914, is being used at present on a number of railways for the lining of tunnels and similar construction work. In addition to the Chicago, Burlington & Quincy tunnel at Bonneville, Wyo., on the Thermopolis-Orin Junction extension, this method has been adopted for lining a double-track tunnel on the Louisville & Nashville, about 65 miles south of Nashville on a relocated line extending to Athens; for three tunnels recently completed in realinement work on the Oil City branch of the Pennsylvania Lines; and for placing about 100,000 cu. yd. in retaining walls, etc., for the Northern Pacific track elevation work at Spokane, Wash. An interesting use of this method which shows its possibilities has also been developed in the construction of a sewer tunnel at Memphis, Tenn., which is being built under pressure. In this case the machine is located outside of the tunnel and the pipe is carried through the lock into the forms. The only change necessary in the operation of the machine in this case is an increase in the air pressure at the mixer equal to the pressure maintained in the tunnel.

The Louisville & Nashville tunnel, on which work has just been started, is 1,600 ft. long, one track being used by the operating department and the space for the other being utilized for construction. Two sets of traveling Blaw steel forms 35 ft. long are being used to place the lining and all concrete will be supplied by one pneumatic mixer and conveyor located at the portal. One of the forms will first be placed 800 ft. from the portal or at the center of the tunnel, and the other form 400 ft. from the portal. They will then be filled alternately through a pipe from the mixer and gradually moved toward the portal. The other half of the tunnel will then be handled from the opposite portal in the same way. The Pennsylvania tunnels are also being lined by pneumatic mixers located at the portal, the contractor in this case, however, using separate wooden side wall and arch forms. Several of the machines mounted on cars, are being used in the Spokane track elevation work, which has only recently been placed under contract.

The Burlington tunnel referred to above is 800 ft. long and was excavated about a year ago in rather treacherous sandstone which required timbering throughout its length. This line is in operation while traffic is being handled on a temporary line over the summit, pending the completion of the permanent lining in the tunnel and the excavation of the west approach cut.

The work of lining the tunnel consists of three operations, first, the removal of the timbers; second, the erection of the Blaw steel forms, and third, the mixing and placing of the concrete. The timbers are pulled down by a dinky engine attached to cables running through snatch blocks located in the center of the track, to the bottoms of the uprights. When the posts are pulled out, the roof falls, after which the debris is cleared away and loose rock is picked down to insure the safety of the men erecting the forms. To further protect the men, planks are laid from the remaining timbers to the concrete, so that in case any small pieces of rock should fall they will be caught on these planks, or if a large rock should come loose it will be impeded by the planks and will give warning in time to permit the men to get out of the way. The amount of timber taken down at one time depends upon the apparent safety of the rock above and varies from 5 to 20 ft.

The erection of the forms consists of placing a steel channel rib which fits the section of the tunnel, and connecting it with the last rib by means of steel plates 4 ft. long and 3 ft. high. These plates are built up solid to the top of the arch, as the fact that the concrete is placed by the compressed air method permits the forms to be built complete before concreting begins. The steel ribs of the forms are 4 ft. apart, corresponding to the length of the plates, and from one to five sections are set up at a time, depending upon the character of the rock.



Interior Views of Tunnel Lining Equipment. At Left, Pneumatic Mixer Car with Hose Connections to Air Line; in Middle, Material Hopper of Mixer Car and Delivery Pipe Entering Forms Through Bulkhead at Crown of Arch; at Right, Finished Section of Lining, a Section of Form in Place and Mixer Car in Operating Position

The mixing and placing outfit consists of a pneumatic concrete mixer and conveyor mounted upon a 40-ft. flat car, equipped with bins holding 26 cu. yd. of material. The cement is stored in bags under one of the bins and discharged toward the center of the car through chutes into a measuring hopper. This measuring hopper is lifted and tilted automatically to discharge into the pneumatic mixer. The lifting device consists merely of a 6-in. air cylinder. The 8-in. delivery pipe leads from the mixer under the car and vertically up at the end to the crown of the arch, where a 90-deg. elbow enters through the bulkhead of the form. Air is supplied from a compressor at the mouth of the tunnel through a 4-in. main laid on brackets fastened to the timber posts and a connection can be made at any point from the main to the air receiver on the car by means of a hose. This car was completely described in the issue of March 18, 1914.

The proper sized compressor to run a portable outfit of this kind is about 300 cu. ft. capacity of free air per minute, compressed to 80 or 100 lb. In beginning the work, however, a compressor of 134 cu. ft. capacity was furnished by the railway

from one of its yards, as this was the only compressor available at that time. This compressor was operated by a gasolene engine and was found to be badly worn and inefficient. The amount of air furnished by the compressor was approximately 50 cu. ft. per minute. This, of course, had its effect upon the output of the mixer and conveyor and is mentioned because it applies to the data given below.

The car is run into the tunnel by means of a dinky engine and "spotted" at a point next to the forms. The upper elbow of the delivery pipe remains suspended in place so that when the car is spotted the upper pipe can be bolted to the pipe on the car, which comes directly under it. The air connection is then made and concreting immediately begins. The car is loaded by a portable derrick, which handles a wooden skip, as a clamshell bucket was not at first available. This wooden skip is loaded by several men, shoveling the bank run gravel into it, and is then lifted above the bins on the car and dumped into them.

The first work done by the outfit, which included the lining of the first 20 ft. of forms, required five carloads of concrete material to fill the form. The entire work of tearing down timbers required 128 men hours; the total time erecting forms was 229½ men hours; the total time loading gravel and cement on to the car required 140 men hours; the total time required for mixing and placing concrete in the forms was 204 men hours; the total yardage placed was 132 cu. yd. From these figures the number of men hours required for the various items per cubic yard of concrete was as follows:

	Men hr. per cu. yd.
Tearing down and clearing timbers	.97
Erecting forms	1.74
Mixing and placing concrete	1.5
Loading gravel and cement	1.06

Two delays were experienced on this form, 3½ hours on account of blowing off an 8-in. nipple and replacing the same, and 2 hours on account of a derailment of the derrick car. The substitution of a clamshell bucket, when available, will cut the cost of loading the car to about ⅓ men hours, or 10 cents per cu. yd., and the substitution of a 300-ft. compressor will make it posible to mix and place one batch per minute. The number of batches on the car varies between 112 and 118. The time required at present to unload one car, including time of transporting and connecting and disconnnecting pipe, is about 210 to 240 minutes.

These pneumatic mixers and conveyors are leased by the Concrete Mixing & Placing Company, Chicago.

NEW YORK CENTRAL ANNUAL TRACK INSPECTION

The New York Central & Hudson River has just made public the results of its annual track inspection for 1914, the inspection of the main line between New York and Suspension Bridge being made by the general committee, and the branch lines by sub-committees from other divisions. While no cash prizes are awarded the supervisors, their respective subdivisions are rated on their condition. A. M. Clough, supervisor of subdivision 23, between Buffalo and Rochester, received the highest rating of 83.5, while supervisors P. S. Green of Syracuse, N. Y., and W. N. Skelton of Utica received the second highest rating of 82.8.

The section foreman receiving the highest rating on each main line subdivision received a premium of $3 per month for the coming year, while the foreman having the best section on each division except the electric division, received an additional premium of $2 per month for the year. Nine premiums of $2 per month were also awarded to foremen on branch line sections and ten prizes of $3 per month to foremen of yard sections.

SWITCH INSPECTION AND TEST

By W. F. Rench,
Supervisor, Pennsylvania R. R., Perryville, Md.

The condition of the various members that compose the switch connection and the adjustments maintained are of such vital importance that frequent tests are prescribed on all roads, and in order that these tests may not be perfunctory it is customary to require that they be conducted jointly by a representative of the signal department and of the track department and that they be made on or about certain dates.

To facilitate the rendering of the periodical reports each switch or cross-over in a given interlocking is numbered and each switch rail distinguished by a letter. The opening at switch points is prescribed by the standards of the road and is usually 4 in. The opening at which the switch lock will foul when the switch is closed is fixed by the signal practice of the road and is generally 3/16 in. Terms are indicated to describe the condition of the switch points, stock rails and ties as good, fair and bad. The gage is measured and any other features are noted under the head of remarks. The signal department's responsibility is in the adjustment of the interlocking connections, the track department's responsibility in the condition and general maintenace details of the several members of the switch connections. As the signal department does not have any concern with the frogs or guard rails these are covered in another test made by the track foreman alone. The switch test develops the exact condition of the switches and their connections at intervals, which for the best practice is every two weeks, and not only safeguards the traffic but supplies an excellent defense in the event of an accident from some obscure cause.

These tests by the signal and track maintainers are invaluable, but there is still necessary the occasional inspection by the signal supervisor and the more frequent detailed inspection by the track supervisor. The inspections by the supervisor of track should take in the physical characteristics of the entire layout, and his notes should be full and be recorded in permanent form. He should especially observe the points of frogs to note if they are being touched by passing wheels as indicating a loose guard rail gage, and he should then try the gage and order the necessary correction. This test is especially important at crossings which require constant attention to gage. The condition of all switch points should be noted and also, as far as possible, their adjustments when thrown for a movement. The two rails should be sighted to discover any tight gage that may have developed, as the movement of the rails through creeping sometimes introduces tightening of as much as 5/16 in., whereas ⅛ in. is the most that is entirely safe. It should be observed particularly whether the joints at the heel of the switches and the insulated joints are properly surfaced, and whether the full complement of bolts is inserted at the rail joints. Any points unfavorably reported by the maintainers should be examined.

The inspections made by the higher officers are usually by proxy, many divisions having a special duty man who makes such tests for the division officer with an occasional test by the representative of the engineer maintenance of way. The division superintendent and his staff make superficial observations of the interlocking layouts about once in every three months when the cabins are being inspected as to their sanitary condition.

The record of switch inspection and test is very important in view of the insistence of the road and civil authorities for exact information in the investigation of derailments. One has but to walk over a few miles of railroad to note the many parts of cars that drop off in passage, and to wonder that so few of them drop into the throats of frogs and switches. Cases where such obstructions have caused derailment are not rare, but the proof of the occurrence is seldom found and the record of the exact condition of the switch connections may be the needed evidence to clear the maintenance department.

Conducting Track Inspection on the Grand Trunk

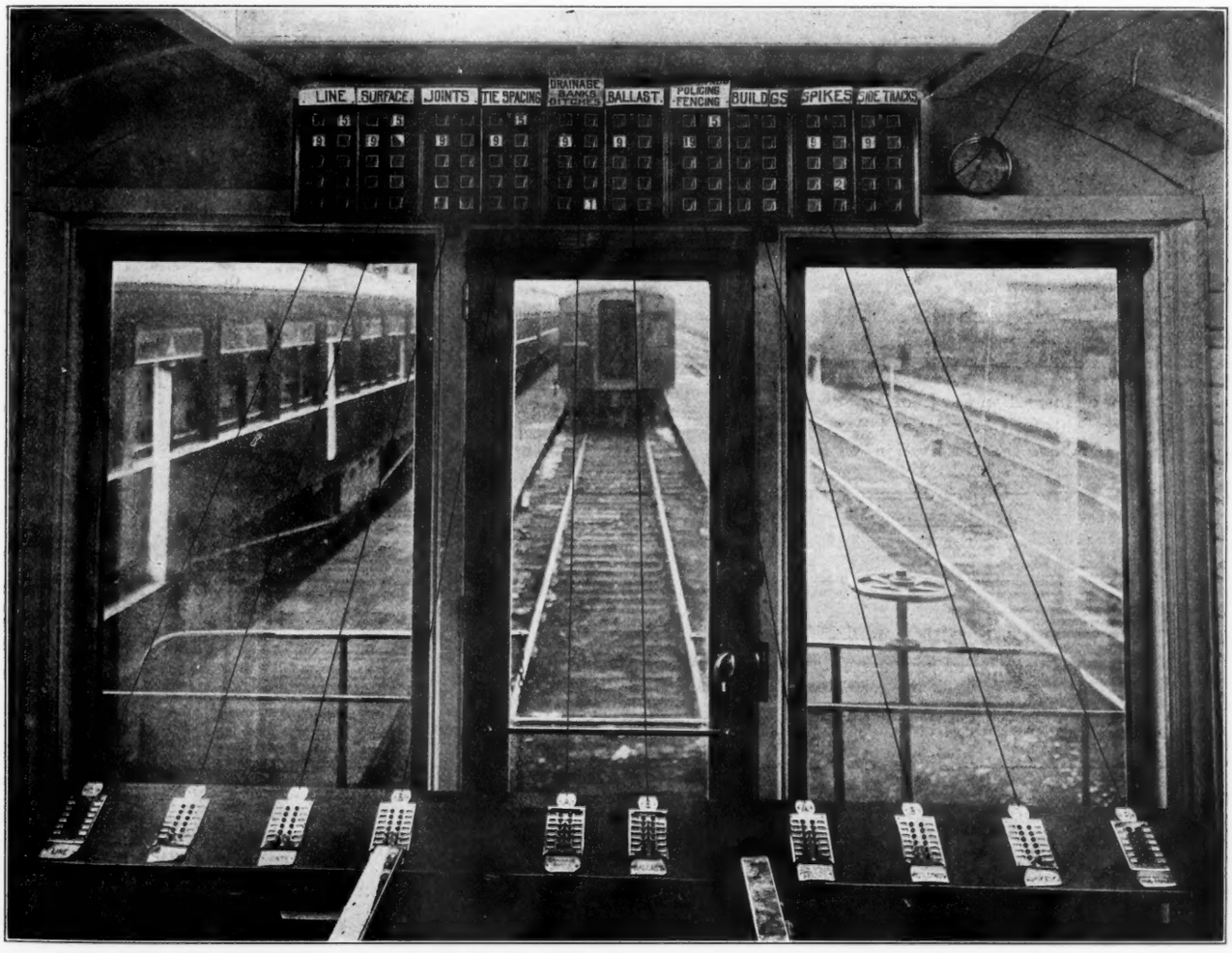
A Description of a Car Recently Designed for This Purpose and Methods of Rating Different Sections

The Grand Trunk inaugurated a new track inspection system this year, which, while similar to that used on a number of other roads in purpose and the general method of conducting it, has a number of interesting features. An inspection car is used, which is a rebuilt baggage car fitted with an observation end and seats for 32 persons arranged on an inclined floor to give an unobstructed view of the track. This car is pulled at the rear of a special train at the rate of about 25 miles an hour when making the inspection.

The detailed inspection is made by a committee of five men who are seated side by side across the rear end of the car. Below the observation window are placed 10 sets of push buttons electrically connected to indicators above the window, which are easily visible from any point in the car. By means of each set of push buttons an observer can register on the corresponding indicator any number under 10 with one decimal. Each set of push buttons is used for one of the 10 features which are observed, each of the five observers being responsible for two of these features. For example: one man grades on line and surface, another on joints and tie spacing, etc.

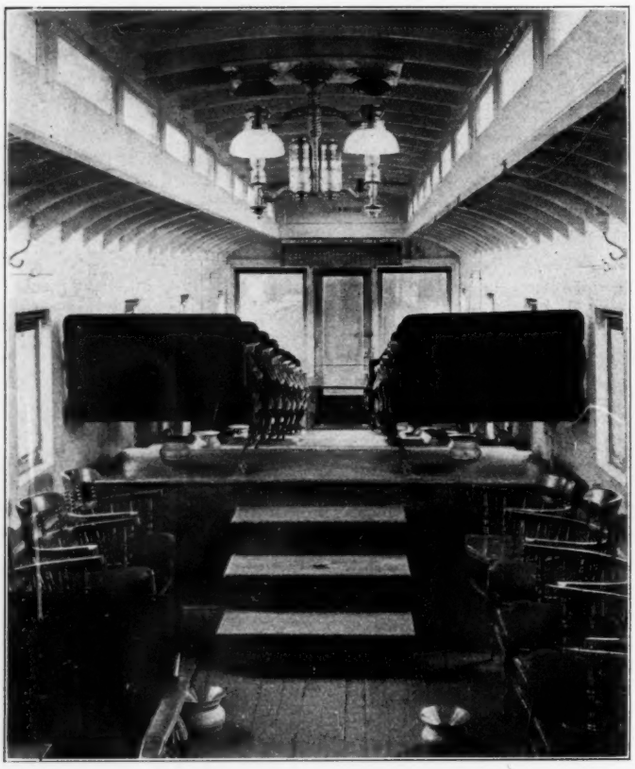
As each milepost is passed the supervisor on whose territory the train is running, calls the number of the milepost. Each of the observers decides what grade, on a basis of 10 as perfect, the features he has been watching over the past mile merit, and he records those decisions by the push buttons. The grades shown on the indicators are copied down by a clerk on a form reproduced herewith, and from this record the average for each mile is secured by weighing the various items according to the percentages shown on the blank. The averages for all of the miles on a given section are averaged to secure the grade for that foreman.

The observing committees on the main line inspection are ordinarily composed of superintendents and supervisors, the latter being used preferably for line and surface, joints and tie spacing. These men make observations only on territory not under their charge and the committees are usually changed at the end of each day's run or at the completion of the inspection on a superintendent's district. In order to secure close supervision over the observations made by this committee, a revisory committee of three men sits immediately behind the five



Observation End of Inspection Car Showing at the Bottom the Bank of Push Buttoms Used by Observers in Registering the Grades and at the Top the Indicators Which Display These Markings. The Light Lines in the Cut Connect the Corresponding Push Buttons and Indicators

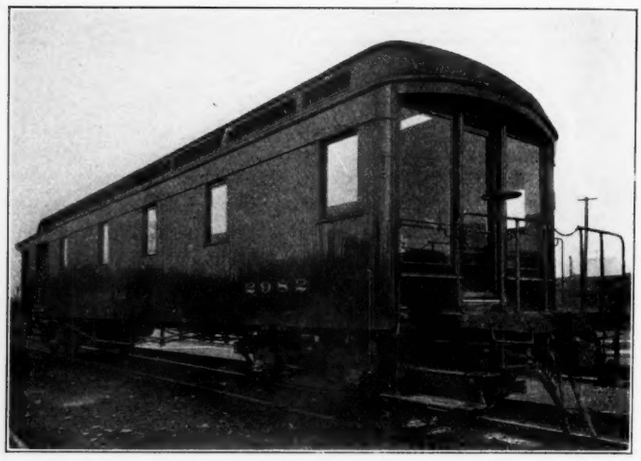
observers and, when necessary, calls their attention to tendencies to rank uniformly high or low. It is usually possible in this way to correct any wrong tendencies in grading immediately, although if thought advisable, the revisory committee may alter



Interior View of Inspection Car Looking Towards the Rear End Showing Seats for Observers and Bank of Indicators Above the Observation Window

the record slightly. This revisory committee on the main line is usually composed of the grand division staff officers, who include division engineers, superintendents of bridges and buildings and superintendents of track. On branch lines the observers are in most cases section foremen and the revisory committee supervisors or superintendents. One stop is made on each section to measure the gage and test the level, although this is not counted in the grade of the section, as it refers only to a single point.

No cash prizes are awarded as it is felt that such an inspection cannot equate properly for differences in natural conditions affecting the track. The result of the inspection showing the grade on each section is published and distributed to all fore-



The Grand Trunk Track Inspection Car

men and the officers interested and the toolhouse sign is awarded to the foreman having the highest average on each superintendent's division, each grand division and the system. It has also been proposed as an inducement to the foremen that those receiving the highest average one year will be taken along on the inspection trip the following year.

In addition to this system of inspection above outlined, which is of course an examination of conditions as found by disinterested parties having no connection with the particular district inspected, recognition is given to the section foreman who has accomplished the best result during the year, taking into

GRAND TRUNK RAILWAY SYSTEM

(Ch. Eng. 61)

ENGINEERING DEPARTMENT

ANNUAL INSPECTION 19____

_____ Division. _____ District. _____ Supervisor B. & B.
_____ " Track.

Committee 1. _____ Committee 5. _____
" 2. _____ " 6. _____
" 3. _____ " 7. _____
" 4. _____ Revisory Com. _____
Date _____

Mile	Section No.	Foreman	Com. 1		Com. 2		Com. 3		Com. 4		Com. 5		Average for Section
			A 15	B 15	A 15	B 10	A 10	B 10	A 5	B	A 10	B 10	
			Line	Surface	Joints	Tie Spacing	Drainage Banks Ditches	Ballast	Stn. Gr'nds Policing Fencing	Buildings	Spikes	Side Tracks	

Form Used for Recording the Grades Fixed by the Inspection Committee for Each Mile

account physical conditions, force expenditure, etc. This, of course, cannot be determined by committees not familiar with these details and is accomplished by a committee formed of the track supervisor, division superintendent and superintendent of track, the latter a staff officer of the general superintendent. These three men determine the section foreman on each district who is entitled to this recognition and a letter is written to him, signed by the general superintendent, to this effect. In addition the names of these men are given in the report.

The first inspection was made on the main line during the third and fourth week of October. The branch lines were covered later at irregular intervals as it was convenient to handle the car. A special train carried a party of about 60 over the entire main line, the train including six business cars, one Pullman, one baggage car and the inspection car. In addition to the chief engineer, who was in charge of the inspection, the train was accompanied by the engineer maintenance of way, the three general superintendents, all the division superintendents, and their staff officers.

PHYSICAL EXAMINATIONS OF SECTION FOREMEN

BY W. E. SCHOTT

Section Foreman, Southern Pacific, Gila Bend, Ariz.

Every section foreman, when entering the service of most of our standard railroads, is required to go to the company surgeon to be examined as to his physical fitness. This is undoubtedly a wise precaution, not only to protect the railway company against any possible future damage suit, but also to insure greater safety to the traveling public and to other employees.

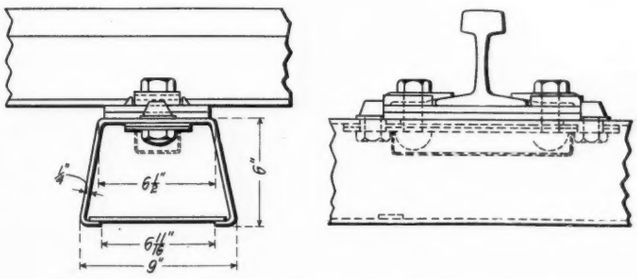
As yet, a satisfactory definition of what constitutes exact fitness for the position of section foreman is sadly lacking. Rules covering such fitness are applied to all alike, and the consequence is that many applicants eminently fitted for the positions are turned down for some slight physical defect which would not in the least interfere with their duties.

No work in any department of a railroad is harder on the eyes than track work. To sight along and over brightly polished steel rails under a cloudless Texas or Arizona sky for hours and days, months and years, is bound to affect the strongest pair of eyes more or less. The consequence is that at a period when the foreman's usefulness is greatest on account of this experience he is, theoretically, according to the rules governing his physical condition, unfit for his position. One of our western roads after a period of 10 years 80 per cent of the foremen could not pass the physical examination in regard to their eyes, if performed by a physician who followed the rules literally.

On account of the nature of track work it is impossible to have a sufficient supply of experienced men with two perfect eyes, and to sacrifice all qualities necessary to make a good foreman to a slight unimportant defect in his eye seems far from increasing service efficiency. There is no reason why a foreman wearing glasses should not be as safe and competent as one without. A majority of the best and most efficient foremen are not found on big standard railroad systems, but on smaller roads, where they are not barred on account of slight physical shortcomings. As long as the rate of pay of the foreman is the same on the first day of his employment as 20 years after he will continue to make changes from one road to another, trying to improve his condition. Every change forces on him a re-examination and sooner or later he will meet an especially particular physician, who will reject him. Although he may be capable and thoroughly competent he will have to turn to a smaller road, which in most cases will gladly accept him. By taking up this matter the railroads could relieve to some extent the perplexing problem of securing sufficient capable section foremen.

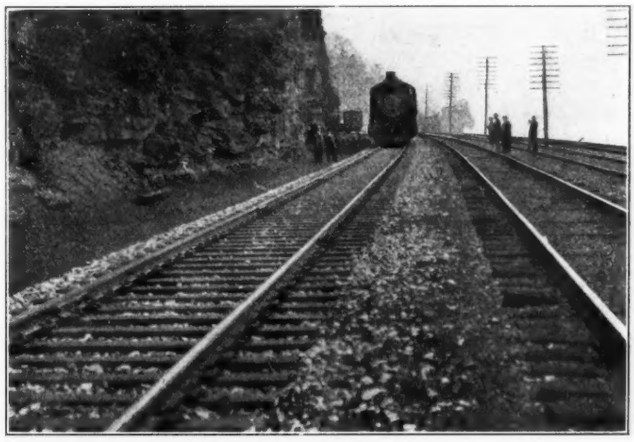
STEEL TIES UNDER HEAVY TRAFFIC

An installation of 203 steel ties made by the National Steel Tie Company, Harrisburg, Pa., has been in service since December, 1913, in the main westbound passenger track of the Pennsylvania Lines at a point one-eighth mile west of Emsworth, seven miles west of Pittsburgh, Pa. The traffic at this point is very fast and heavy, including about 100 passenger trains and a great number of freight and local passenger trains. The track is on a two-degree curve. An inspection of these ties was made 10 months after they were installed and it is stated that both the ties and the condition of the track are as good as when first installed.



General Details of Design of the National Steel Tie

The general design of the tie is shown in the accompanying drawing. It has an inverted channel section with steel straps connecting the lower edges. The rail is secured to each tie by two bolts, which pass up through a stiffening plate on the underside of the top of tie, the shell of the tie, an insulation pad, the tie plate, and a clip on which the nut is held down. These clips fit snugly within recesses provided in the tie plate so that it is impossible for them to turn. One end of the clip is beveled to fit firmly against the flange of the rail. The insulation pads, made either of waterproof paper or fiber, serve the double purpose of taking up the shock and vibration caused by a moving train, and providing insulation against electric current.



Main Line Passenger Track on the Pennsylvania Lines Laid With National Steel Ties

The tie plate is designed to take the thrust of the rail, thus preventing the rails from spreading, also the wear in the rail can be taken up by simply turning the plates around. The outer two bolts shown in the figure merely support a casement, shown in dotted lines. This protects the main bolts from concrete or asphalt, or any other material with which the shell of the tie is filled.

A SUGGESTED ORGANIZATION FOR TRACK MAINTENANCE

By G. C. Crites
Southern Pacific, Tucson, Ariz.

The section gang as now organized is forced to localize its work on the bad spots, leaving the "out of face" work for the extra gang. After a soaking rain, much of the section gang's localized "spotting" is undone, for the spots and the undisturbed portions are not equally affected, while the extra gang's "out of face" work is uniform even when saturated. However, the extra gang laborer is a rover and a spasmodic worker and therefore his work never has the quality and nicety of small detail that is found in the work of the section gang.

The section gang should be so organized that it can handle its work in an effective and economical manner. Each regular section gang usually has houses and grounds, representing a cost of from $600 to $6,000, and special tools that would equip a gang three or four times its size, such tools costing from $60 to $200. Interest, taxes, insurance and depreciation on the above will amount to from $80 to $770 per year. Supervision will cost from $700 to $1,250 per year per gang; making a total overhead cost of from $780 to $2,020 on from $1,300 to $6,000 worth of labor. This big overhead cost should be reduced and a more effective gang organized.

If a roadmaster with 150 miles of main track is allowed 0.8 of a man per mile, he will have 120 men for track work. By dividing these into six gangs, an economical and efficient unit would be secured. All the advantages of an extra gang would be obtained with the quality and nicety of a section gang's work. An organization of 20 laborers is easier to build and keep than one of from 3 to 10 men. Organization within the unit is possible and interest in the tasks may be created and held. If curtailment of expenses is necessary, the gangs can be cut to 0.6 or even 0.4 of a man per mile without altogether destroying the workable unit. Such gangs could take their track out of face every two years, besides keeping the whole safe for operation.

Permanent headquarters should be furnished. If possible these headquarters should be in a small town, but surely at a telegraph and water station. Such headquarters will cost from $3,000 to $7,000 and special tools from $60 to $300. Interest, taxes, insurance and depreciation will amount to from $375 to $875 per year and supervision will cost from $2,100 to $2,500 per year, making the total overhead costs from $2,475 to $3,375 per year on from $8,000 to $22,000 worth of labor. Under the present system the overhead costs may reach 150 per cent of the labor costs. Under the proposed organization it should seldom reach 30 per cent of the labor costs.

The section foreman in charge of this permanent gang should be king of his 25-mile domain and his pay should measure up to the position. He should have 80 per cent as much salary as the roadmaster. The place will find the man if salary and authority are given. The roadmaster would polish up a bit, as he would have six competent men under him. To get from their place to his would be only a small step and not the wide jump that is now required when a section foreman is promoted to roadmaster. Further, a foreman with 20 able-bodied consumers, and probably several voters under him would have a better status in the community he inhabits.

The signal maintainer should, of course, report to the section foreman. Complete and accurate statistics of everything pertaining to the section should be made up and kept on the section and the maintainer should perform the clerical work involved. He should inspect track daily, and once a week or oftener, as necessary, the foreman should make his inspection with the maintainer. In this way the entire gang's little "joy ride," while the foreman is inspecting track and switches, would be cut out. The maintainer would know the statistics of the section and the plans of the foreman, and, if he was capable, he would have a gang of his own some day. Where there are no signals, a trackwalker, rated as assistant foreman, would do small jobs and make the daily inspection. The section should be provided with an inspection motor car for the use of the maintainer or trackwalker.

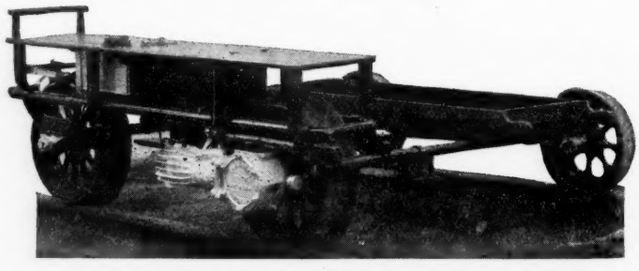
There are many foremen of present section gangs who would not measure up to the new foreman's job. Some of these men are good trackmen, but they usually have to be told when and where to work and they have a world of trouble with their "books." One of these old-time trackmen should be given to each section as a track assistant at from 65 per cent to 75 per cent of the foreman's salary. He would handle the gang in the absence of the section foreman and, with a small detail, do the "spotting up" and other small jobs not worthy of the whole gang's attention.

As a "safety first" man, an old-time carpenter should be detailed with each section. He should be provided with a small shop and substantial living quarters. He should see that the section tools are kept in working condition, fix the loose or broken boards in station platforms, make all light repairs to buildings, look after fences, road and station signs, inspect roadway openings and do the small painting and whitewashing jobs.

LIGHT MOTOR CAR OF IMPROVED DESIGN

The new No. 36 gasolene motor car which has been placed on the market by Fairbanks, Morse & Company, Chicago, is the lightest car of the two-cycle type ever built by that company. It was designed for the use of roadmasters, linemen and signal maintainers, whose work requires a car light enough to be handled by one man and at the same time strong enough to carry two when the occasion arises. Another distinctive feature is the fact that the battery box and gasolene tank are located below the deck, leaving the seat free of all obstructions.

The car has a single frame of steel tubing which combines strength with light weight. It is fitted with 17-in. main wheels and 14-in. guide wheels with wooden centers and M. C. B. flanges, the front axle being 1½ in. in diameter, brass bushed, and the rear axle 1⅛ in. in diameter with removable



Steel Frame Motor Car of Light Weight and Strong Construction

brass bearings in malleable iron boxes. In addition to the equipment usually provided with these cars, a tray which rests on and is secured to the guide arms is regularly furnished with this car. For convenience in transportation, the tray and the guide arms can be removed from the main frame in one piece, permitting the parts to be easily loaded for baggage car shipment. The weight of the car equipped with the tray is approximately 360 lb.

The power plant is the same as the standard two-cycle engine equipment used on other cars built by this company. The engine has a rated capacity of four horsepower, is of the two-cycle, air-cooled type, direct connected to the front wheel, and is enclosed in a dust-proof crank case. Lubrication is effected by mixing oil with the fuel and also by two com-

pression grease cups on the main bearings. The engine is mounted by suspending it from a malleable iron casting attached just below the main frame. The battery box under the seat contains five dry cells which are conveniently accessible through a door in the seat.

REMODELED MAIL CARS FOR HOUSING GOVERNMENT FIELD PARTIES

As the field work of the engineering parties sent out by the Interstate Commerce Commission in the physical valuation of railways requires their frequent moving from place to place, it is desirable for them to make their headquarters in cars. To accommodate the parties sent out on its North Dakota lines last

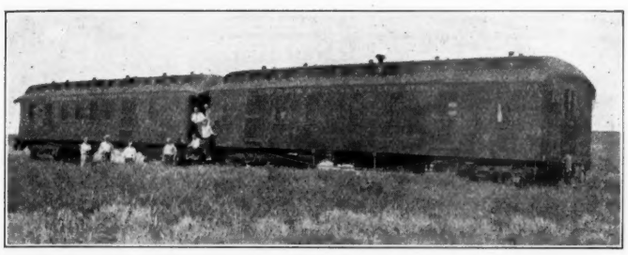


Fig. 1—Government Outfit Cars, Sleeping Car at Left and Diner at Right

May, the Great Northern remodeled some of its old 50-ft. mail cars which serve as very convenient and pleasant quarters for the men.

Each party was supplied with two of these cars, one being

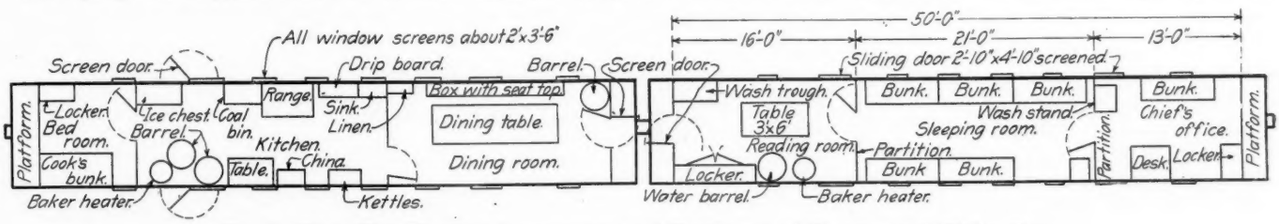


Fig. 2—Floor Plan Showing Arrangement and Equipment of Sleeping and Dining Cars

arranged for sleeping and the other for dining. Both cars are partitioned off into three compartments. The office of the chief of party is located at one end of the sleeping car. Next to it is the sleeping room proper, which is 21 ft. long and contains

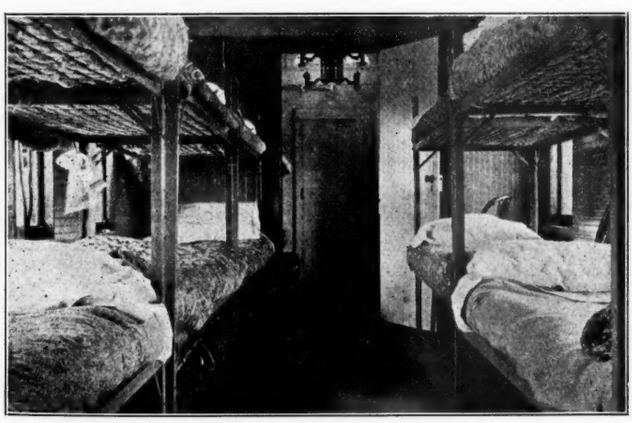


Fig. 3—Interior View of the Sleeping Car

ten bunks arranged as shown in Fig. 3. The third compartment is furnished as a reading room. In the dining car one end is devoted to the dining room proper. The kitchen occupies the middle section and at the other end is the cook's bedroom and bunk. There are four provision boxes under each car, two on each side. These boxes are 3 ft. by 3 ft. by 12 in. deep, are very convenient for carrying supplies, and at the same time do not take up any space inside the cars.

The partitions are constructed of ¾ in. pine flooring, matched and dressed on both sides, and are held in place by end cleats. The doors are of the same material and located as shown in Fig. 2. All lockers and closets are made of dressed flooring. The tables, washstands, box seats, etc., are made of dressed and matched pine. All the interior exposed woodwork was painted a light cream color and the exterior of the cars was repainted with the company's standard dark coach color. Fine meshed copper screens are provided for all doors and windows, and the office, sleeping and reading rooms are furnished with carpet. The cars are heated by a hot water system, using Baker heaters, and lighted by double oil coach lamps. The ventilation was very good, due to the numerous doors and windows, so that it was not necessary to improve it. Six of these cars were used on the North Dakota lines during the past season.

WOOD PRESERVERS' CONVENTION PROGRAM

The eleventh annual convention of the American Wood Preservers' Association will be held in the Florentine room of the Congress hotel, Chicago, on January 19-21, 1915. A growth in membership of nearly 100 is reported during the past year and a large attendance is expected at the convention. The policy of this association is undergoing a change in regard to its convention program, increasing emphasis being placed on the reports of standing committees. At the coming convention reports will be presented by committees on Preservatives, Specifications for the Purchase and Preservation of Treatable Timbers, Wood Block Paving, Plant Organization, Miscellaneous Subjects, and Constitution and By-Laws. In addition to these reports the following papers of special interest to railway men will be presented: "A Problem in Air Seasoning Ties," by A. H. Noyes, assistant treasurer, Ayer & Lord Tie Company; "Temperature Changes in Wood Under Treatment," by George M. Hunt, of the Forest Products Laboratory; "Mechanical Life of Ties as Affected by Ballast," by Earl Stimson, engineer maintenance of way, Baltimore & Ohio; "Economical Use of Steam in Connection with Wood Preserving Plants," by A. M. Lockett, mechanical engineer; "Determining the Soundness of Timber Before Treatment," by C. M. Taylor, superintendent, Port Reading Creosoting Plant; "Facts on Creosoted Piling," by T. G. Townsend, piling inspector, Southern Railway; "Facts on Treated Ties," by J. H. Waterman, superintendent timber preservation, Chicago, Burlington & Quincy; "Sill Ties," by F. J. Angier, superintendent timber preservation, Baltimore & Ohio, and "Creosoted Piling," by Edmund Christian, general manager, Norfolk Creosoting Company.

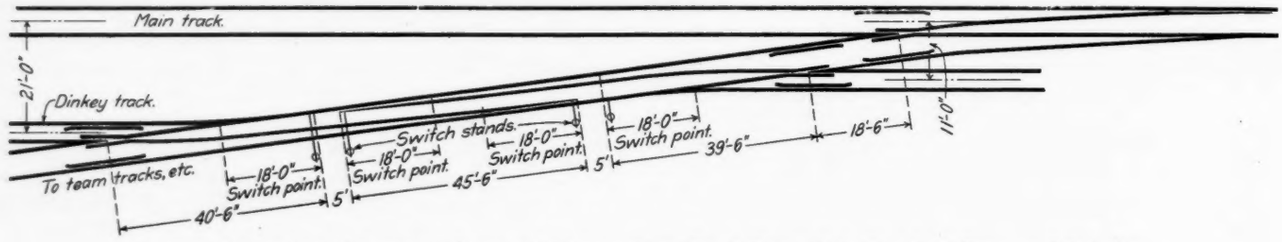
CORRECTION

In the article entitled, "A Simplified Method for the Location of Sidings," in our issue of November 20, page 963, the length of the chord was shown in Figs. 3, 4 and 5 as "2 R sin x." This should have read "2 R sin ½ x." Also, in the first paragraph on page 965 the character ⌓ was substituted incorrectly for △

A SPECIAL CROSSING OF A NARROW GAGE AND A STANDARD GAGE TRACK

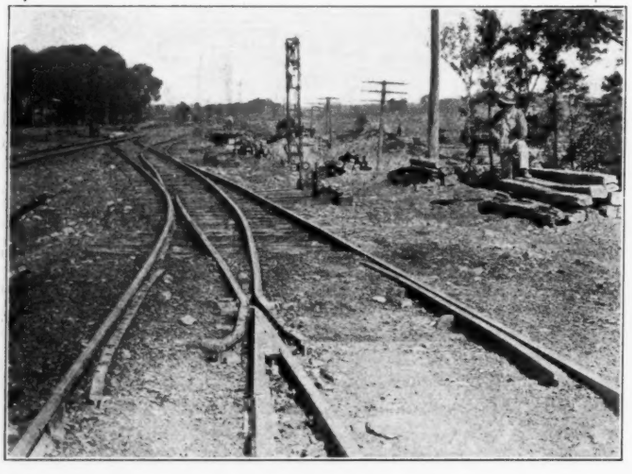
BY T. C. HERBERT
Resident Engineer, P. C. C. & St. L., West Jefferson, Ohio.

In connection with the second track and grade reduction work on the Pittsburgh, Cincinnati, Chicago & St. Louis between Alton, Ohio, and Glade Run, it was necessary for the grading contractor to cross a standard gage side track with a narrow gage track at West Jefferson. This crossing was subjected to considerable use by both standard and narrow gage equipment, but there was not time nor justification for the installation of a special crossing frog, neither were there any movable or double-point frogs available. So it was decided to construct a crossing out of standard frogs and switches which were on hand. The crossing, as shown by the illustrations, consisted of two No. 8 frogs and four switch points operated separately with a switch-stand for each point. The switch targets showed white when set for the normal position in line for side track movements.



Details of Crossing of Standard Gage and Narrow Gage Track Using Only Standard Frogs and Switches

A crossing watchman, who also acted as a switch tender, was kept on duty during the working hours of the contractor, and at night the crossing was locked clear for the side track. It would be possible to pipe connect such a crossing with the main track switch, thus eliminating the necessity for a watchman, and this would perhaps be advisable if traffic over the crossing was very light. In an emergency such a crossing could be used on main track by pipe-connecting the crossing switch points with the signals.



Arrangement of Switch Stands and Signals for Operating Crossing of a Narrow Gage Track and a Standard Gage Track

The crossing, as constructed, was installed by a gang of 25 men in seven hours, and as there was no charge for material the entire cost amounted to only $35.

INSPECTION.—Next to the intelligent selection of help, the inspection of the product is the most important factor of efficiency. —*American Machinist.*

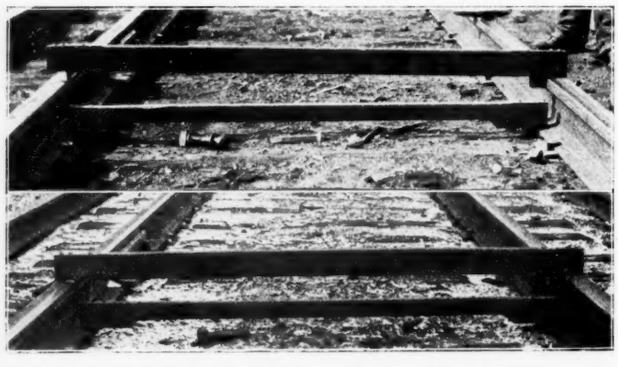
GAGING TRACK BETWEEN RAIL FLANGES

BY E. KEOUGH
Roadmaster, Chicago, Burlington & Quincy, Aurora, Ill.

The matter of correct gage in relaying rail has always been a problem for maintenance men, but as laborers are becoming less skilled and the height of rails has increased, the satisfactory gaging of such track by the common method has become even more difficult. When the adzing of ties is left to common laborers a fair gage is about all that can be expected. Some roads are adzing all new ties by machine before they are treated, which must do away with considerable poor gage, but will not prevent it all unless spike holes are put in the ties before laying the rail.

In order to secure a correct top gage the writer has experimented with a flange gage with very satisfactory results. It was found that in relaying 100-lb. A. R. A. rail on an old bed the new rail after settling to place was sufficiently close to correct gage to need no further gaging when being surfaced or retied. Where the standard track gages are used the rail will usually require regaging after it settles. An inspection of such cases generally shows that the bottom is too wide and the top widens a corresponding amount after settling.

With the degree of care used by present laborers no error over a small fraction of an inch should exist by gaging at the flange. Trial measurements show, however, that practically all rail in good main track on hand-adzed ties actually inclines inward, whether plated or not. When 100-lb. rail shows correct gage at the head it will be found that the base is practically 3/16 in. wide. Where rails are in correct gage and stand vertical the surface of the ball is but little over half covered and has the appearance of tilting outward. In adzing ties for relaying rail all laborers seem to have the same personal equation of adzing a little deeper on the inside edge.



Top and Bottom Gages at Time of Laying Rail and 24 Hours Later

The accompanying photographs illustrate what may be expected when using the bottom gage. In this case the standard gage was 3/16 in. tight, as shown in one view, and 24 hrs. later, when the second picture was made, the top gage dropped into place of its own weight and just stuck slightly. Had this top gage been used when the rail was spiked to place it certainly would have resulted in ¼ in. wide gage after the rail had settled.

Overcoming Defective Foundations for Three Piers*

Settlement Arrested by Construction of Annular Caissons at Iron Mountain Bridge at Little Rock, Ark.

By C. E. Smith

Assistant Chief Engineer, Missouri Pacific System, St. Louis, Mo.

The St. Louis, Iron Mountain and Southern has two bridges across the Arkansas river at Little Rock, Ark. The lower bridge, commonly known as the Little Rock Junction bridge, is founded on masonry piers, timber cribs and pneumatic caissons on rock, and is used only by freight trains from northeastern points to Louisiana and Southeastern Arkansas. It consists of one 352-ft. 10-in. swing draw-span, three 253-ft. 4-in. simple truss spans, and one 127-ft. 11-in. simple truss span and trestle approach, all single-track, built in 1883. The south abutment is of masonry built on the rock that outcrops on the south bank. The pivot pier, commonly known as pier 2, and piers 3, 4 and 5, are rock-faced, concrete-filled, masonry piers, about 45 ft. high, resting on filled timber cribs and pneumatic caissons about 40 ft. high, the masonry of the draw-pier being annular, with a well down to the crib. Piers 6 and 7, are rock-faced, concrete-filled masonry piers built on piles. The only specifications that can be found for the piers are as follows:

"The piers are to rest on pneumatic caissons sunk to rock and are to be filled with concrete, with timber cribbing reaching from the roof of the caissons to 4 ft. below low-water mark. These cribs are to be drift-bolted and planked on the outside and filled with sand and stone; on these cribs the masonry is to be started and built up to grade line.

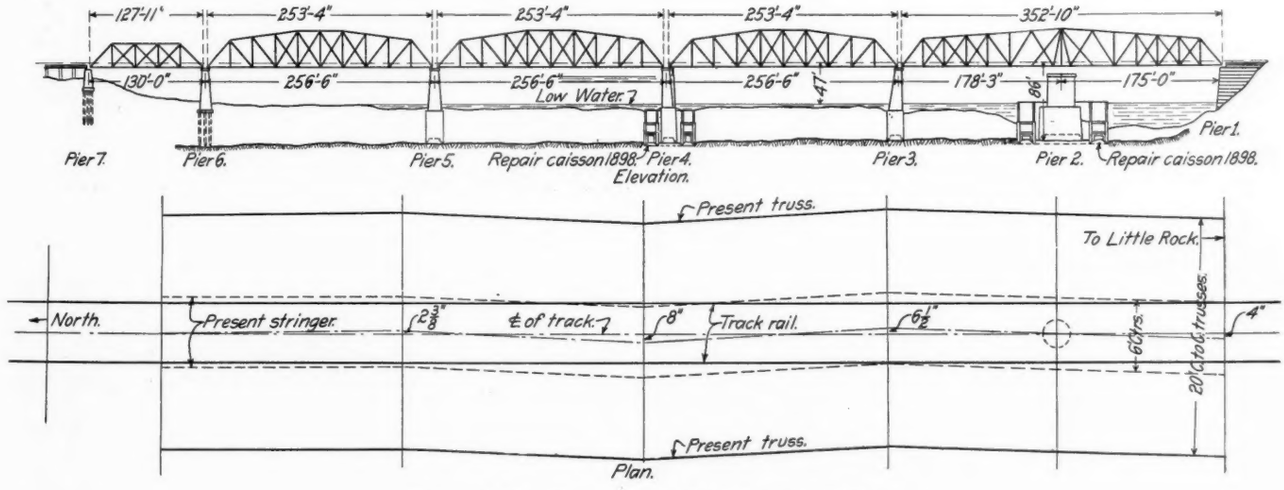
"Piers are to be 6 ft. 6 in. wide under the coping and 20 ft. long, with semicircular ends, with a batter of ½ in. per ft. on the sides and up-stream ends, but no batter on the down-stream ends; the piers are to consist of solid walls, averaging 2 ft. thick, built of dimension stone so as to make the joints not to exceed ½ in.; the inside space is to be filled with concrete. This refers to three piers.

"The draw-pier is to be 30 ft. in diameter under the coping, with an 8-ft. wall and the center to be left open; the pier is to rest on caissons sunk to rock and filled with concrete with the crib as before.

"The fifth pier on the east bank is to rest on piles sawed off and capped below low-water mark; it is to be 6 ft. 6 in. wide under the coping and 20 ft. long, with semicircular ends, and is to have a batter of ½ in. per ft. on the sides, but no batter on the ends; in other respects it is to be the same as piers 1, 2 and 3."

The spans were so well designed and constructed that they are now carrying safely the present-day heavy engines and trains, and will continue to do so for many years. The design and construction of the south abutment and of piers 6 and 7 were good and well executed. The design of the four pneumatic piers, although not in accordance with the best present-day practice, was adequate, but the construction was so faulty that trouble was experienced with them from the first, and the efforts that have been made during a period of 30 years to correct the defects resulted in a sequence of events that partook of the nature of a farce comedy in the face of impending disaster, which latter was narrowly averted.

There was nothing unusual or defective about the design or construction of the caissons, but they were very poorly located and carelessly controlled during sinking, resulting in their having been founded considerably out of place—from two to three feet in one or two cases. The timber cribs, extending vertically upward from the caissons, reflected at their tops the improper location of the caissons.



Plan and Elevation of Little Rock Junction Bridge

The design evidently contemplated filling the cribs with rip-rap, and for 25 years it was not believed that any other filling had been used. After that time, however, it was suspected, and after 30 years it was learned that, instead of having been filled with rock, only a small quantity had been used, most of the filling having been sand discharged from the caisson.

The incorrect location of the caissons and cribs was discovered before starting the masonry, and as the spans were on the ground, the errors in location were corrected partly by placing the masonry piers to one side or the other of the cribs, partly in the batter of the piers, and partly in the placing of the bedplates on the pier tops.

Pier 4 was built near the north edge of the crib and was given equal batter on the two sides, and pier 3, the north rest pier of the draw-span, was built near the center of the crib; but the north face was given a batter of 1½ in. per ft., and the south face

*Abstracted from a paper in the Proceedings of the American Society of Civil Engineers for November, read before the society on December 16.

was built plumb; the draw-span barely got a bearing on pier 3, and the next fixed span reached well over on the pier.

EARLY TROUBLE

The early record of the trouble is not clear, but it appears that, immediately after the completion of the bridge, the pivot pier under the draw-span (pier 2) and pier 4 began to settle and lean. As the bed of the Arkansas river is composed of fine sand which scours and shifts greatly during floods, it was thought that the settling was due to scour, the opinion immediately being formed that the cutting edges had not been founded on rock. Consequently, large quantities of rip-rap were unloaded around the piers, only to be washed down stream in following floods and requiring replacement. In addition, from time to time as necessity arose, the spans were shifted back and forth, to keep their bearings on the piers, the tops of which had been made so small that very little variation could be permitted. The movement of the pivot pier was quite pronounced, and necessitated frequent leveling and adjustment of the draw-span, at great expense.

After the railway forces had handled the problem for 15 years, the late W. M. Patton was called in as consulting engineer. He studied the history of the bridge and, after making borings through the timber crib and caisson under the pivot pier within the well inside the pier, and examining the exposed portions of the crib by divers, came to the conclusion that the caissons were not founded on rock, and gave a full and very plausible report and recommendation.

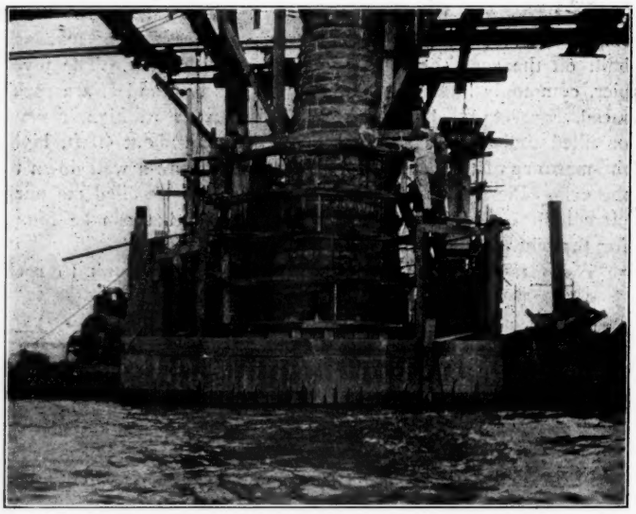
In brief, Mr. Patton concluded that one corner of the cutting edge of each pier rested on rock and the remainder on inferior material, which condition, together with the eccentricity of loading, caused the settlement, and that greater scour at one corner than at the others caused the greatest settlement at the corner

Little Rock Junction Bridge, Little Rock, Ark.

of greatest scour. He suggested pumping grout into the underlying sand to convert it into concrete, removing the inferior material under the caisson and replacing it with concrete, and building an entirely independent annular coffer-dam. His diver found that the timbers were sound, but that some damage had occurred to the crib sheeting and timbers on account of the settling, and that the filling was of small rock, sand and gravel. Mr. Patton recommended replacing the sheeting and filling the spaces with concrete. He recommends the sinking of annular caissons and coffer-dams to rock, supporting the span on falsework, removing the material between the old and new piers, putting jacks under the cutting edges to right the piers, and underpinning them with concrete.

The work of sinking the annular caissons and coffer-dams went forward in the fall of 1898, and was completed early in the summer of 1899. At pier 4, a timber caisson, about 50 ft. by 70 ft., was constructed around the old pier. Two rows of piling were driven around the old pier, about 8 ft. or 10 ft. apart, and were capped and cross-capped; the caisson and crib were built on top of these caps to a height of 12 ft. Large screws 16 ft. long were then used to lower the crib until it floated. The crib projected 4 ft. above the water, and the cutting edge floated about 4 ft. above the bed of the river; sand was used to fill the crib to sink it, while men were raising timber on top of the crib.

On April 2, 1899, at 41 ft. below low water, hard shale was struck near the center of the up-stream end. At an elevation of 45 ft., the inside cutting edge on the south side was landed on rock except about 10 ft., where the rock was 6 in. below the



The Steel Caisson and Coffer-Dam Around Pier 3

edge. The rock under the outside cutting edge on the south side was from 12 to 13 in. below it. However, the sand was taken out down to the rock, and the working chamber was sealed with from 2 ft. to 4 ft. of concrete, depending on the depth of rock.

The crib was built 58 ft. high, the top being 13 ft. above low water when the caisson was sealed. Later the top of the crib was disconnected from 6 ft. to 7 ft. below low water after concrete had been placed between the old and new cribs. The sealing of the working chamber was completed on April 24, 1899.

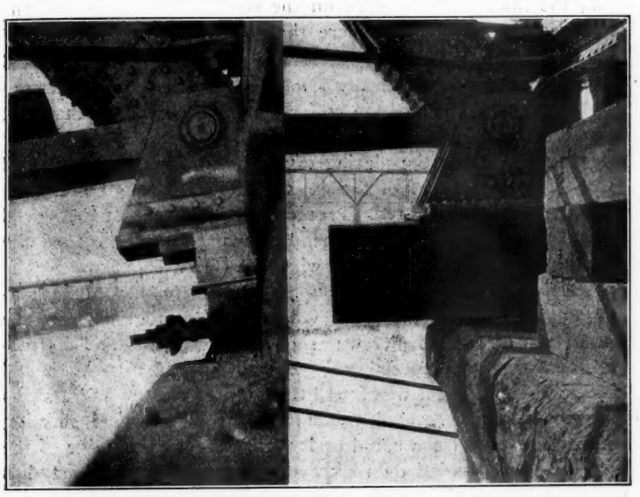
Investigation of the timber in the old crib disclosed crushing on the north side, but only to the extent of compressing the timber, and not dividing the grain. The timber was good and sound. A great deal of the 3-in. sheeting was found to be torn off, and it was seen that the spaces between the timbers of the crib were filled with sand and loose rock. The sheeting which had been torn off was replaced. It was also observed that the deck or top of the old crib dipped from 1 in. to 1½ in. from a point near the center on the south side of the pier toward the up-stream end.

On July 1, while the loose material between the new coffer-dam and the old crib was being excavated, it was discovered that the pier had settled about ½ in. This led to the immediate abandonment of the excavation, but the spaces on the north and west sides were driven full of piles, with a penetration of about 15 ft., and the space already excavated was filled with concrete up to the top of the old crib. None of the material within the old crib was removed, and no effort was made to grout it or to fill in the vacant spaces with concrete. In fact the sheeting that was replaced effectually prevented the concrete from flowing into the vacant spaces within the crib. The concreting around the old pier was completed on July 6, 1899, and both walls of the annual coffer-dam were then removed, down to 6 ft. or 7 ft. be-

low low water. The annular caisson was about 50 ft. wide and 70 ft. long, the sides were 10 ft. apart, and spaces from 6 ft. to 7 ft. 6 in. wide were left between the old and new work.

The work at the pivot pier was similar in character, except that the new caisson was 70 ft. square and the concrete about 15 ft. thick, the extra depth having been caused by scour and not by excavation.

The contractor considered the removal of the material between the new and old caissons to be very hazardous, and he continually recommended that only part of the material be removed and that the remainder be confined by placing concrete over it. Unfortunately the railway was guided by his advice in this matter. It is to be regretted that, after having incurred the great expense of sinking the annular caissons, more benefit was not derived from them.



Truss Shoe Overhanging Bearing

Truss Shoe Supported on I-Beam Grillage

On account of the large quantity of concrete placed around the pivot pier, and the depth to which it reached, 15 ft. below the top of the crib, no further movement has been detected in this pier. However, the movement of pier 4 was not arrested, but as the settlement and movement continued a policy of "watchful waiting" was followed for several years. The situation again became critical early in 1906, when pier 4 had moved so far that one of the spans was in imminent danger of falling off.

I-BEAM SUPPORTS FOR SHOES

One of the first duties assigned to the writer when he entered the bridge department of the railway, late in 1907, was an inspection of this bridge to determine how to maintain it in safe condition. At that time pier 4 had moved out so far from under the shoes that the center of the end pins was almost exactly over the edge of the timber blocking under the shoe, and the edge of the shoe overhung the edge of the pier.

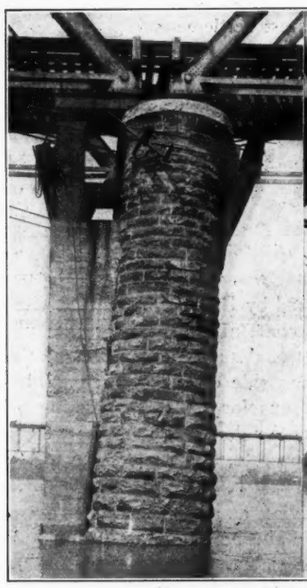
The roller end of the span to the south being on pier 4 permitted the pier to move out from under. The fixed end of the span to the north being on pier 4, the thrust caused by the leaning of the pier in that direction had crowded the roller end of this span on pier 5 against the fixed end of the next span. This thrust, added to the similar, though less, defective construction of pier 5, caused the latter to lean north, crowding the roller end of the next span to the north, against the fixed end of the north span on pier 6, bringing three spans in direct contact. On hot days when the bridge was not loaded the chord bars in the end panels of these spans could be seen to be more or less buckled, but they always straightened out under trains, undoubtedly because the elasticity of the timber cribs permitted the piers to move back and forth.

Immediately following his first visit to the bridge, the writer worked up plans for placing a nest of I-beams under the truss shoes at each end of pier, so that the overhanging ends of these beams would afford support for the end of the next span south. There was only sufficient depth for 15-in. I-beams at the high end of the pier, but at the low end there was sufficient depth for 20-in. beams, the difference in height being due to the settlement.

The plans first contemplated driving piles on both sides of pier 4 to be used for jacking during the placing of the I-beams, but on account of the extreme length of the piles required (from 80 ft. to 90 ft.) and the hazard attending their maintenance in the Arkansas river, it was decided to avoid their use and jack from the pier top.

After placing the I-beams the spans were shifted slightly to remove their interference, and the rollers were cleaned and oiled. No further attention was paid to the placing of the falsework. The bearing having been made safe the matter of permanent repairs was then given further study.

In 1908 some one got the idea that it would be of advantage to provide further rigid support for the overhanging ends of the I-beams on the high side of the pier by building a concrete footing on the wide edge of the crib up to low water and placing a steel bent on top of that footing. The I-beams under the pedestals were to be shifted far enough south to get bearing on the bent, and the spans were to be shifted as far south as possible in order to bring the load over toward the high side of the crib. This method might have been very effective had it been possible to move the spans any great distance, but on account of the proximity of the south span to the draw, and of the north end of the north span to the edge of pier 5, only a 6 in. to 10-in. movement could be made, and the effect on the line of pressure was barely perceptible. However, the work was done in the fall of 1903 by the Missouri Valley Bridge & Iron Company at a cost of about $2,000.



Pier 4, Showing Steel Bent Encased in Concrete

Pier 3 After Work Was Completed

Following this work no appreciable movement in the direction of the bridge was apparent for several months, but the movement at right angles to the bridge appeared to increase its rate, indicating that the work had no appreciable effect.

The movement of the pier was greatly dependent on the scour line. When the current shifted away from the pier, the bed of the river filled up and stopped the movement; when the opposite was true, the movement was resumed.

Following the work in the fall of 1908 the observations were continued, and the matter of proposed permanent repairs or re-

construction was kept constantly alive for 3 years, during which time scheme after scheme was evolved and considered, but nothing was started until the fall of 1911.

For two or three years prior to 1911 the channel of the river had been moving away from pier 4 and concentrating under the draw-span, resulting in the building up of the river bed around this pier with clear fine sand which early in 1911 covered the top of the crib and reached up on the masonry within 1 ft. or 2 ft. of extreme low water. This sand evidently filtered into the crib and gave increased supporting power in addition to that provided by the sand that enclosed it. As a consequence the movement of pier 4 gradually slowed down, so that it was barely perceptible, and the great uneasiness that had prevailed for several years was partly allayed.

In order to protect and preserve this sand surrounding the pier, the writer attempted in the fall of 1910 to secure authority to spend about $2,000 to construct a standard brush and pole mattress, about 150 ft. square, around pier 4, to be securely bound together with wire and wire strand, and covered with rip-rap placed in pockets of the mattress to be formed by placing two sets of poles one across the other on top of the mattress to prevent the rip-rap from rolling off.

At the low stage of the river following the request for authority, the work could have been done without barges or other floating equipment and brought to completion in 30 days. The authority was not granted, and after the next flood it was not needed as much of the sand had been washed away.

While the river bed was building up around pier 4 it was scouring away around pier 3, the north rest pier of the draw-span, and this pier started to move quite rapidly directly up stream at right angles to the axis of the bridge.

The movement in 1911 was more rapid and constant than any experienced previously in the other piers, and indicated the necessity for immediate action. The pier did not move dangerously in the direction of the bridge. Its natural tendency would have been to move south as the plumb south face and eccentric bearings of the spans made the pressure heaviest on the south side. It was restrained from movement in that direction, however, by rods and yokes which made this pier an anchor for the pull of pier 4.

FINAL PLAN OF REINFORCEMENT

The method of reinforcement that was finally brought to successful conclusion was first suggested by E. J. Pearson, first vice-president of the railway. To overcome all uncertainties he suggested securing the necessary additional supporting power by the use of a pneumatic caisson on each side of the old crib. This was extended later by adding caissons for the ends, forming an annular caisson surmounted by a coffer-dam, the space above the annular caisson to be filled with concrete, doing the same to the crib, and encasing the old pier in a new reinforced concrete shell.

Unfortunately, the delay in arriving at a decision as to what would be done at pier 3 consumed the best months of the year for the work. The change to pneumatic construction, necessitating the assembling and erection of the pressure plant and the construction of the caisson, further delayed the work up to the time of the flood period. The compressor plant was finally ready, and the steel caisson was shipped early in November.

The old records showed the old caisson under pier 3 to be 14 ft. by 31 ft., so the dimensions of the inner cutting edges of the new caisson were made 16 ft. by 33 ft. The caisson was made of steel primarily to reduce its necessary width and consequently the displacement; the presence in the old bridge-material yard of a large number of duplicate second-hand floor-beams which could be converted readily into a caisson also encouraged the use of steel. It was decided to build up a coffer-dam on the outer wall of the caisson, connecting the coffer-dam to steel lattice work or towers bolted to the roof of the caisson. These towers were provided in order to form the backbone of the rigid framework it was known would be required to brace the new coffer-dam against the old crib during excavation.

The greatest care was taken in the design of the joint between the caisson and the coffer-dam. The timbers in the bottom row, 8 in. thick, were cut to fit the steel as closely as possible, and were set in a bed of hot tar and oakum. Surfaced timbers were used, and each layer was set on the next below in hot tar and caulked. Tar-paper was then placed over the timbers and 2-in. matched sheeting placed outside. The lower ends of the sheeting were driven into a groove filled with hot tar and oakum, over the roof of the caisson, formed between the bottom timber and the upstanding leg of the angle at the top corner of the caisson. A space about ½ in. wide between the sheeting and the angle was then caulked. To bind all parts together effectually and to provide additional weight for sinking, a 2-ft. 6-in. layer of concrete was then placed over the roof of the caisson enclosing the bottoms of the towers. This concrete was banded to the steel roof by a large number of ¾-in. bolts 21 in. long fastened to the steel plate and extending vertically into the concrete. The construction of the remainder of the coffer-dam was similar to that just described.

During and after the placing of the 30-in. layer of reinforced concrete over the roof of the caisson, the sinking progressed as fast as the work permitted. Trouble was continually experienced by the caisson catching on the protruding upper ends of the sheeting planks of the old crib, which had been torn loose by the settlement of the timbers and bulged by the pressure of the material escaping from the crib. On all the old records available the caisson of the old pier was shown to be plumb, and a clearance of 2 ft. was supposed to have been allowed between it and the new caisson, but it was found that the old caisson had a sharp batter, which necessitated ripping off the old vertical sheeting before the new caisson could be landed. The cutting edge of the old pier was founded on rock everywhere except at short dips which had been filled with concrete.

All the material within the new caisson had to be removed through the locks because sufficient pressure could not be maintained to force the sand through the blow pipes. Mattson locks were used and permitted the rapid removal of the material. No other particular difficulties were encountered.

The cutting edges were everywhere landed on rock, except over short dips, which were cleaned out and filled with concrete. The working chamber was filled with concrete carefully rammed to the roof, and before it had set, the lower sections of the shafting were also filled with grout.

The filling of the old pier was found to consist of some rip-rap and more sand. In order to remove the sand much rock had to be taken out. In fact, all the loose rock was removed with the sand, and only the tight rock was permitted to remain. The latter and the entire inside of the crib was washed out with a strong jet and then filled carefully with concrete. On account of the rather rapid settlement of the pier up stream, that end of the crib was first concreted, and, following the placing of that stiffener, the squeezing of the timbers at the down-stream end caused the pier to settle in the other direction, righting itself several inches. The entire space inside the coffer-dam was filled with concrete, being brought up as the concreting of the crib progressed.

After filling the crib and the surrounding space with concrete, the pier was safe, but, as it was canted so much that it presented a poor appearance, and as the draw-span had only a very small bearing on the pier and was causing the upper courses of masonry to break away, the pier was encased in a reinforced concrete shell. As the new caisson had made the footing large enough, the reinforcement was built for double-track. The bridge seats under the spans were entirely renewed in concrete finished at the proper level for double-track spans. The difference in level was made up by concrete pedestals placed in sections.

No falsework was used for the support of either span, and the bridge was never out of service during the conduct of the work.

The outer surface of the timbers in the crib under pier 3 were squeezed down at the ends an almost imperceptible amount. The

upper timber was burst open on account of the crushing load.

On account of the success at pier 3, all concerned were agreed that pier 4 should receive like treatment, making use of the caisson and coffer-dam sunk in 1898. Soundings showed that the top of that coffer-dam had been cut up when the upper courses were removed, and it was necessary to smooth it by cutting off drift-bolts under water and removing loose timbers. It was decided to make an effort to extend the outer wall upward and make it sufficiently tight to permit the pump to expose the inner wall, and, after extending the latter, to rely on it for the rest of the work.

The extension was made in a very short time, and a canvas having been stretched around the work, the dam was pumped out at the first trial. The inner wall was then very carefully dressed down in the dry and extended upward thoroughly water-tight, making it possible to pump out the water between that and the pier and start excavation. The concrete between the 1898 coffer-dam and the old crib was first removed on the south side, but was not disturbed on the north side until some time later, after the yokes and cables were in place anchoring the pier to pier 3.

The removal of the material down to rock was slow and tedious. The old coffer-dam had been badly racked during sinking, and large leaks were found all the way down. They were overcome, and the rock was laid bare and covered with concrete up to the top of the caisson of the old pier, after which the crib was cleaned out, filled with concrete, and surrounded at pier 3.

Some of the timbers were crushed to 6 in. in height, and on account of the inclination of the pier new cracks developed in the timbers while the excavation progressed. The weakest portions of this crib were concreted as they were reached. Attention was given to the up-stream end, and excavation was first made there. The movement of the pier increased while that work was in progress, but was immediately arrested when the excavated pockets were filled with concrete.

In fact, by concreting at the up-stream end and cleaning out the spaces at the down-stream end, the pier was made to right itself, the top moving back about 9 in. The first concreting was done in the two up-stream pockets of the crib, for its full width for a height of 5 ft. below the top, after which 5 ft. more below that were placed. The situation was always well under control, and the top of the pier could have been sent in any direction by guiding the work. The underpinning was hurried as much as possible, however. In placing forms within the crib and concreting individual pockets the men worked inside the crib. No falsework was used while pier 4 was under reconstruction; the pier carried traffic at all times.

The reinforced concrete shell placed around pier 4 is practically a duplicate of that placed at pier 3. The tie-bars at the bottom were passed through the pockets in the crib and concreted in, instead of being passed through the pier. At this pier the ends of the spans were shifted sideways to permit the construction of each concrete pedestal in one piece.

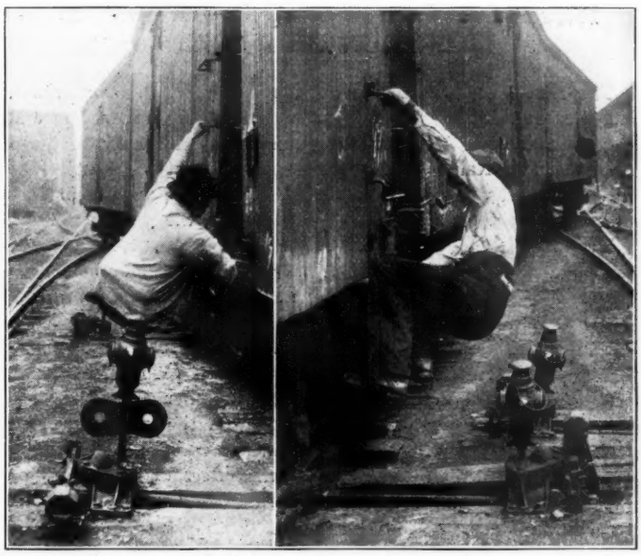
The small tops of these piers, their reported movement, and the frequent shifting of the spans, all contributed to a very poor condition of the bridge seat on pier 5, on which the stones were breaking out under the end of the south span which rested close to the edge of the pier. To strengthen the bridge seat, the top 10 ft. of the pier was encased in a reinforced concrete jacket about 9 in. thick. The sides were connected by passing the reinforcing rods around the curved ends of the pier and also by three sets of rails set vertically in the reinforced concrete at the middle and quarter points of the length of the pier. The lower ends of these rails were attached to the pier by 2-in. anchor-bolts set in grouted holes. Their upper ends were connected by 2-in. rods extending across the pier tops in channels cut in the bridge seat and filled with concrete. All cracks in the pier top were carefully grouted. The bridge seat appears to have taken on a new lease of life.

Following the reconstruction of piers 3 and 4 and the reinforcement of pier 5, the entire bridge, which was badly out of line and level, was lined and leveled. It was found that the draw-span was somewhat twisted and one end hung lower than the other. As far as could be done without injury to the span, the inequalities were corrected.

The work on the three piers and spans cost about $100,000, which is much more than it would have cost had the work on pier 3 been started earlier and the floods avoided. The reinforcement of piers 3 and 4 was executed on a force-account basis by the Bates-Rogers Construction Company. The adjustment of the spans and the reinforcement of pier 5 were executed by the railway company forces.

AN IMPROVED SWITCHSTAND BANNER

One of the measures adopted by the Chicago Junction in its campaign to increase the safety of its employees has been to replace the old banners which extended above the switchstand with a new type of banner invented by one of the company's switchmen which is no higher than the switchstand proper. The new banners have been made by straightening the old ones and cutting the proper holes for the fastenings in the new position. The shape of the target is shown in the accompanying illustration. It is 7 in. wide at one end, 3 in. at the other and 16 in. long. These banners have been applied on yard ladder tracks and at points where tracks are close together, thus decreasing the danger of switchmen being struck by the banners when hanging on the sides of cars or engines.



Old Style Banner Showing Dangerous Condition **New Type of Banner Not Extending Above Switchstand**

ABSTRACT OF ENGINEERING ARTICLES

The following articles of special interest to engineers and maintenance of way men, to which readers of this section may wish to refer, have appeared in the *Railway Age Gazette* since November 20, 1914:

A Comprehensive Low Grade Trunk Line Development.—When the projected lines have been completed, the Chicago, Burlington & Quincy will have a low grade trunk line from Billings, Mont., to Paducah, Ky., a distance of 1,500 miles and a connecting line to Denver. The plan for working out this important development and the interesting construction details of the line between Thermopolis, Wyo., and Orin Junction, recently completed, were described in an illustrated article in the issue of November 27, page 999. Editorial comment on this development appeared in the same issue, page 995.

Construction of the Gwynn's Falls Arch Bridge.—The Pennsylvania Railroad is completing the construction of a four-track reinforced concrete bridge over Gwynn's Falls in Baltimore, Md., consisting of four arch spans, the design and construction of which are typical of the best in modern bridge practice for such structures. An illustrated description of this work was published in the issue of December 4, page 1037.

The Mechanical Elimination of Seams in Steel Rails.—An abstract of a

paper by Robert W. Hunt, read before the American Society of Mechanical Engineers, in which was outlined a new method of eliminating seams in rails by removing the surface metal of the ingot by a milling machine, was published in the issue of December 4, page 1055.

Comparative Service Tests of 100-lb. Section, P. S. and A. R. A. Section A Rails on the Pennsylvania Lines.—W. C. Cushing, chief engineer maintenance of way, Southwest System, Pennsylvania Lines, has outlined in a paper recently published the results of extensive service tests of rails on the Pennsylvania Lines showing the traffic handled, the amount of abrasion and the number of broken rails of each type. An abstract of this paper was published in the issue of December 11, page 1078.

Driving a Five-Mile Tunnel Through the Selkirks.—The Canadian Pacific is building a double-track tunnel five miles long under Mt. McDonald at the summit of the Selkirk mountains as a part of a line revision which saves 4.4 miles in distance, reduces the length of the 2.2 per cent ruling grade on each approach, and eliminates 552 ft. of rise and fall and 2,600 deg. of central angle. This tunnel, which will be the longest in America, is being constructed by the use of a pioneer tunnel parallel to the main bore in order to hasten its completion. It was described in the issue of December 11, page 1082. An editorial note commenting on modern tunneling methods, calling attention to the lack of progress in reducing cost on such work as compared with grading and other construction work, was published in the same issue, page 1074.

TESTS ON TREATED AND UNTREATED OREGON FIR PILING

The results of comparative tests, made by H. B. MacFarland, engineer of tests, Atchison, Topeka & Santa Fe, on treated and untreated Oregon fir piling, are published in bulletin No. 168 of the American Railway Engineering Association. The object of these tests was to determine the effect of the steaming process of creosoting upon the physical properties of the piling.

Two lots of material were selected for test purposes. The logs had ordinarily been cut from three to six months before treatment. Twenty logs, varying in diameter at the butt from 12 to 18 in., and in length from 40 to 60 ft., were selected. From each log two specimens, each 15 ft. long, were cut for test purposes. Ten of the 40 specimens were given regular treatment, known as the 18-hour treatment, and another lot of 10 was given an extra heavy 26-hour treatment for the specific purpose of permitting heavier and deeper penetration. In order to get the best comparative figures as to the effect of creosoting on the different parts of the log, alternate butts and tops were treated.

In the steam creosoting process the material was ultimately subjected to three processes, namely, steaming, removing moisture and filling with creosote. Just previous to treatment, the logs were taken from the salt water in which they had been soaked and the bark removed. They were then placed in the treating tanks, and by the introduction of steam were slowly brought up to a temperature of about 330 deg., which was maintained for 1½ hr. A vacuum of about 28 in. was then produced and the temperature reduced to a minimum of 190 deg., this condition being maintained for 10 hr. The tanks were then filled with oil at 190 deg., and an average pressure of 75 lb. was maintained for a period of five hours, or until the piles had taken up the proper quantity of creosote, after which the oil was transferred from the treating tank to the general storage tank, and the timbers removed.

In every case the treated material showed a decided loss in strength as compared with untreated. The greatest loss was in transverse strength, due to the influence of treated sapwood. There was also a considerable loss in compressive strength. The material was found to be very refractory to all kinds of treatment, while subjecting this wood to high abnormal temperatures and pressures, extending over considerable lengths of time, caused permanent deterioration of the fiber.

The purpose for which the material is intended should be taken into account in the consideration of comparative results. The transverse strength of piling is not of as great importance as the compression strength. The loss in compressive strength is manifested in the failure of piling to withstand the sudden severe vertical stresses applied by the pile-driver. It is also important that the piling have sufficient strength in shear parallel to the grain to prevent "shelling out" during the driving. The tests showed that the deterioration and loss of strength resulting from treatment is a minimum when treated under as nearly normal conditions as possible. Excessive time and high temperatures of steaming should be avoided.

The following conclusions were drawn:

The depth of penetration of creosote is mainly dependent upon the depth of sapwood.

The heartwood is almost impervious to treatment.

The depth of penetration of creosote is the same in the butts as in the tops.

The depth of penetration of creosote should be interpreted to mean the depth of "active" penetration.

Tests of minor specimens show that injury to fiber through method of treatment is not localized to treated fiber alone, but extends throughout the whole specimen.

The transverse strength of Oregon fir piling is decreased 42 per cent due to the steaming process of creosoting.

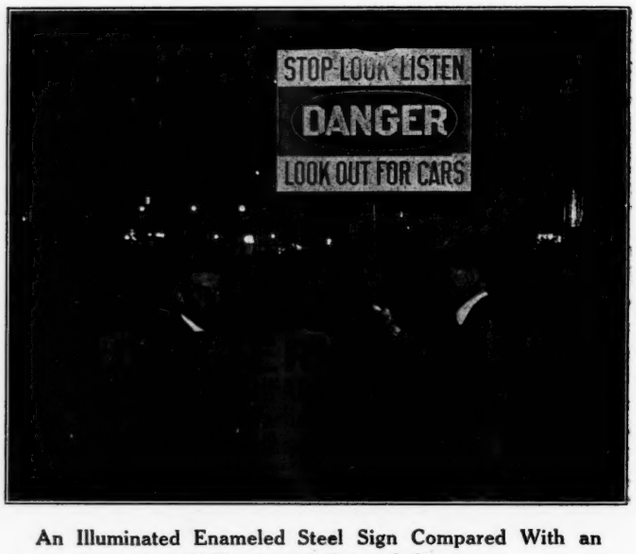
The compressive strength perpendicular to the grain is decreased 32 per cent due to the steaming process.

The compressive strength parallel to the grain is decreased 27 per cent due to the steaming process.

In general average, the strength of Oregon fir piling subjected to the steaming process of creosoting is only two-thirds its original strength.

ENAMELED STEEL SIGNS

The Stonehouse Steel Sign Company, Denver, Colo., has recently developed an enameled steel sign which is especially adapted for use at highway crossings because of its conspicuousness, its rigid construction, and the ease with which it can be mounted on almost any kind of a post. The sign is 20 in. by 28 in., with 4-in. white letters on a red center background. It is attached to the post without any bolts, screws or rivets through the enameled face of the sign. This is accomplished by the use of bands bent around the post and bolted to the lips on fasteners



An Illuminated Enameled Steel Sign Compared With an Unilluminated Painted Sign

which extend across the sign and are electrically spot-welded to a ¾-in. angle bar around the edge on the back. These signs may be illuminated as shown in the illustration, which also shows an old painted sign without illumination.

This company also makes numerous other standard and special signs, including one for use in shops and factories where men speaking many different languages are employed. It consists of a standard sign in English at the top with 12 small, but similar signs, arranged below, having the word "danger" translated into as many other languages.

General News Department

All of the principal car shops of the New Haven road have been closed until January 4.

W. H. Lyford, general counsel of the Chicago & Eastern Illinois Railroad, addressed the Chicago Engineers' Club at a luncheon on December 10, on "Handling Freight at Chicago."

By a fire in the shops of the Atchison, Topeka & Santa Fe at Albuquerque, N. M., on the night of December 8, the company suffered a loss of $22,000; parts of two buildings and 14 freight cars.

Dr. Hermann Von Schrenk, consulting timber engineer, of St. Louis, read a paper on Modern Uses of Wood before the Western Society of Engineers, Chicago, on Monday evening, December 14.

At Pinner's Point, Va., on Monday last, 70 employees of the Southern Railway and 41 of the Atlantic Coast Line were arrested on charges of violating the Sunday labor law. The persons arrested were clerks and workmen on the freight docks of the railroads.

The Great Northwestern Telegraph Company, of Canada, announces that the Canadian Northern Telegraph Company has been consolidated with the G. N. W.; and the larger company expects, within a few months, to operate the lines and offices of the Western Union in the maritime provinces.

"Independent Order of Railroad Employees of Pennsylvania and New Jersey" is the name of an organization which has held a meeting at Reading and which announces that application is to be made to the Philadelphia & Reading for increased pay for station agents. The president of the organization is James F. Tatlow, of Philadelphia.

The American and the National express companies have begun suits in Vermont to test the constitutionality of a recent law of that state increasing the taxes assessed against express companies. The new rate is $20 a mile for each mile of railroad over which an express company operates, more than twice the rate formerly in effect.

Although it was reported recently that the members of the shop craft unions had voted to call off the strike which was declared in September, 1911, on the Illinois Central and the Harriman lines, announcement has since been made by the railway department of the American Federation of Labor that the boilermakers voted in favor of calling off the strike, but that their vote was not large enough to offset the vote of the machinists, blacksmiths, car men and sheet metal workers.

The United States Civil Service Commission announces examinations January 12 for the position of telegraph and telephone inspector, under the Interstate Commerce Commission, in the work of valuation of property, salary $1,200 to $1,800 a year. Applicants must be between 25 and 55 years of age. The commission also announces examinations January 20 for six other positions, as follows, the range of salary in each being from $720 to $1,680: Junior railway structural engineer, age not over 36; junior railway mechanical engineer, age not over 36; junior railway signal engineer, age not over 36; junior railway electrical engineer, age not over 36; junior telegraph and telephone engineer, age between 21 and 35; junior railway civil engineer, age between 21 and 36.

A committee of the Senate held hearings at Washington last week investigating charges that the Southern Railway had obtained control over certain minor railroads in Virginia, Kentucky and Tennessee for the purpose of suppressing the coal traffic in the Appalachian coal fields, the purpose being to promote the business of other mines. The committee had employed an investigator who testified as to the deficits of certain roads controlled by the Southern, the charge being that if these roads—the Atlantic & Danville, the Danville & Western, the Cape Fear & Yadkin Valley, the Carolina & Northwestern, the Tallulah Falls and the Knoxville & Bristol—had been devoted to the legitimate use for which they had been constructed, namely, to furnish an outlet for the Appalachian coal mines, they would have been more profitable.

The executive committee of the Chicago Association of Commerce has adopted a resolution in favor of setting the clocks throughout the nation ahead one hour in order to secure more daylight after working hours in the summer months. The resolution also asked the United States Chamber of Commerce to consider the question at its annual meeting in February, in Washington, with the idea of bringing about a nation-wide movement in favor of the change. A special committee of the association held a meeting last week to consider a plan for adopting Eastern time for Chicago instead of Central, but so much opposition was expressed by railroad men present, on account of the confusion which would result if Chicago made the change, that it was decided to push the movement along national lines.

The postmaster general, in his annual report, again proposes that the government shall take over the telegraph and telephone lines of the country. He says that he wishes to see the railways properly compensated for carrying the mails, but at the same time he says that the department has been more than self-sustaining during the last fiscal year, a statement which has no reasonable basis, for if the railroads had been properly paid for carrying the mails, the surplus would have been more than wiped out. The postmaster general again recommends that the rate of one cent a pound for the transmission of periodicals be limited to publications issued oftener than once a month, and that monthly magazines be charged for at the rate of two cents a pound.

The House Committee, at Washington, has reported the Post office appropriation bill for the next fiscal year, with a rider in which are embodied the provisions of the Moon bill for changing the basis of railway mail pay; and Mr. Peters, the chairman of the railways' committee, says that an attempt is being made to secure from the Rules Committee a rule to facilitate the proposed new legislation. Mr. Peters reiterates his declaration that the provision of the Moon bill for payment to the railways on the basis of space occupied is not only unfair in principle, but embodies rates per mile very much too low. With the space in a car fully loaded, the compensation would amount, in many cases, to less per ton per mile than ordinary rates for the transportation of coarse commodities by freight train. The railroads are now losing not less than eight millions annually because of the parcel post, and if the space rates are adopted this loss will be still greater. The small railroads, which are now the worst sufferers from inequitable rates, would lose from 25 per cent to 65 per cent additional if the plan should be adopted.

The different lines that comprise the National Railways of Mexico are again divided into several sections, each under control of opposing political factions. The Cuernavaca division, which runs from Mexico City to the Balsas river, will soon be opened for through traffic for the first time in more than three years. This is made possible by the merging of the territory occupied by General Zapata and his armed forces with that which is under control of General Villa. The branch lines of the Interoceanic in the State of Morelos are also again open for traffic after a long suspension of operations. As an offset to this extension of the opened system, however, the troops of General Carranza are in control of some of the northern divisions running out of Monterey, Tampico, Laredo, Eagle Pass and Saltillo and of a part of the Interoceanic, running from Vera Cruz. The Carranzistas are also in charge of the National Tehuantepec line and all of the Vera Cruz & Pacific, the latter being a part of the National Railways of Mexico. On the whole, the railways of the country appear now to be in about as chaotic a condition as they have been at any time since the revolutionary troubles started, more than four years ago.

The western railways are making an effort to secure a more rigid enforcement on the part of conductors of the rules requiring payment of half fare for children between the ages of 5 and 12; and forms have been prepared for distribution to conductors on which the parent or guardian may be required to certify that the child is under age, in case the parent or guardian makes such a statement and the conductor is in doubt as to its truth. The form contains a notice to parent or guardian stating that the lawful interstate fare for children between 5 and 12 years of age is one-half the regular one way fare, and the lawful interstate fare for children above 12 years of age is the regular adult fare, and that failure of a common carrier to collect published tariff fare constitutes a violation of the interstate commerce law; also that the person who evades the payment of a lawful fare is equally liable, with the carrier, to punishment under this law. Conductors are instructed to give passengers the benefit of any reasonable doubt as to the age of the child. In cases where conductors are absolutely satisfied from observation or otherwise, that a child without ticket is of proper half-fare age, they are instructed to collect half fare covering not only their own run, unless the journey commences and terminates on such run, but to require parent or guardian to purchase at the first convenient stop a half ticket for the child to destination, or to junction point with the connecting line.

R. C. Richards, chairman of the central safety committee of the Chicago & North Western, has issued a bulletin showing that in the 53 months since the safety committees were established on the North Western, there have been 369 fewer deaths and 11,258 fewer injuries on the road than in the corresponding previous period. He has also issued a series of colored charts to illustrate graphically the various causes of accidents. For the years ending June 30, 1912, 1913 and 1914, one chart shows that 401, or 2.2 per cent, of the injuries were incurred in collisions and derailments, while 17,380, or 97.8 per cent, occurred in "little accidents that can be prevented in less time than it takes to make reports." Another table shows that of the employees killed during the three years 17, or 8.4 per cent, were killed in collisions and derailments, while 185, or 91.6 per cent, were killed in little accidents. Another chart shows that of the accidents in which employees were injured while on duty during the calendar year 1913, 5,232, or 81.81 per cent, were caused by careless practices, 131, or 2.05 per cent, were collisions and derailments, 651, or 10.18 per cent, were classed as unavoidable, and 381, or 5.95 per cent, were caused by defective engines, cars, tracks, tools, machinery, etc. Another chart shows for the same year, that of the accidents in which employees were killed, 51, or 76.12 per cent were caused by careless practices, 8, or 10.94 per cent, were collisions and derailments, 1, or 1.49 per cent, was classed as unavoidable, and 7, or 10.45 per cent, were caused by defective engines, cars, tracks, machinery, etc.

Supply-Men's Gifts Disapproved

President Ripley, of the Atchison, Topeka & Santa Fe, has published in the December issue of the Santa Fe Magazine the following letter addressed to all employees:

"Most individuals and companies dealing in railroad supplies have given up the practice of sending Christmas presents to railroad employees and officials. However, to a certain extent the practice was in evidence last year. I have always been opposed to this practice, have discouraged it, and am glad that it is decreasing. I want Santa Fe men to take such action as seems proper to eliminate it entirely. I appreciate that many of the presents given are tokens of friendship extending over many years; nevertheless the practice is bad, and certainly so where the presents have any value. The high standing enjoyed by Santa Fe men makes it all the more desirable that the practice cease."

Passenger Killed in Collision on New York Elevated

In a rear collision of northbound passenger trains on the Sixth avenue elevated line of the Interborough Rapid Transit Company, New York City, on the evening of December 9, one passenger and one trainman were killed and fifteen or more passengers injured. The leading train was standing at the 116th street station and the following train was moving at low speed, yet it was going fast enough to force some distance upward the rear end of the rear car of the standing train and the front end of the leading car of the other. The cars took fire from a short circuit and the bodies of the persons killed (or fatally injured) were badly burned.

It appears that in the second train the electric apparatus of the three leading cars was out of order, and the motorman was riding in the fourth car. The conductor was at the rear platform of the leading car and regulated speed by giving hand motions to the motorman. It is said that these motions were given by flag, although it was after 6 o'clock and quite dark.

Foreign Employees of the Pennsylvania

More than 19,000 employees of the Pennsylvania Railroad were born in those countries now engaged in the European war. More Italians are employed than any other class of foreigners. Of the 137,525 employees east of Pittsburgh and Erie, on September 1, 1914, 33,804 were foreign born, while 103,721 were native citizens of the United States. Of course, many of the foreign born employees have become naturalized citizens of this country. The number of employees from each of 38 foreign countries is:

Italy	13,193	Belgium	11	Denmark	62
Ireland	5,494	Mexico	10	Roumania	60
Austria	4,251	Servia	7	France	54
Germany	2,679	Portugal	5	Syria	38
Russia	1,830	East Indies	5	Australia	14
England	1,407	Chile	1	Brazil	4
Hungary	1,339	Canada	315	India	3
Poland	1,106	Greece	227	Argentine Republic.	2
Sweden	514	Turkey	207	British Guiana	2
Scotland	449	Norway	170	Japan	2
Bulgaria	25	West Indies	113	Panama	1
Holland	20	Switzerland	99	Hawaiian Islands...	1
Spain	12	Wales	72		

Attorney General's Report

The Attorney General, Mr. Gregory (formerly special counsel for the government in the prosecution of the New Haven road), has sent his annual report to Congress. In it he recommends an amendment to the commodities clause of the interstate commerce act to make it more effective. He recounts the history of the cases against the Delaware & Hudson and the Lehigh Valley. In the D. & H. case the Supreme Court construed the commodities clause as prohibiting a railroad from transporting articles in which at the time of transportation it has any interest, direct or indirect, in a legal or equitable sense. It further held that a railroad does not necessarily have an interest, direct or indirect, in a legal or equitable sense, in articles manufactured or produced by a bona fide corporation of which the railroad is a stockholder. In the subsequent case against the Lehigh Valley the court held that if the corporation owning the articles transported by the railroad was so identified with the railroad as in fact to be but an arm of the railroad, then the railroad would have an interest in the articles in the sense of the statute. Under this construction it has been claimed that the statute is not violated unless the railroad has the required interest in the articles at the date the transportation is begun.

The report then goes on to describe the organization of new and separate corporations to take and sell the railroads' coal, and continues: "This plan has been challenged in the case now pending in the Supreme Court of the United States against the Delaware, Lackawanna & Western. The government lost in the district court. Even though it should be successful in the Supreme Court, the commodities clause will still fall short of the purpose of Congress in enacting it, which was, I think, to divorce transportation from production. I recommend an amendment which will prohibit a railroad from transporting in interstate commerce articles which were manufactured or produced by any corporation controlled by it or affiliated with it by having the same controlling stockholders, irrespective of whether such railroad or such controlled or affiliated corporation has an interest in the articles at the time of transportation. It is also necessary, if transportation and production are to be completely divorced, that Congress prohibit any railroad owned or controlled by a producing or trading corporation, and not operated merely as a plant facility, from transporting in interstate commerce articles produced or owned by such corporation, and I recommend appropriate legislation to that end."

International Engineering Congress

Some confusion has arisen between the International Electric Congress, which was to have been held in San Francisco in September, 1915, and the International Engineering Congress, which is to be held during the same month. Owing to the unfortunate situation abroad, and the impossibility of convening the International Electrotechnical Commission, under whose authorization the Electrical Congress was to have been held, it has been decided by the governing body of the American Institute of Electrical Engineers to postpone indefinitely the holding of the Electrical Congress. This does not affect the International Engineering Congress, which goes ahead as originally planned.

MEETINGS AND CONVENTIONS

The following list gives the names of secretaries, dates of next or regular meetings, and places of meeting of those associations which will meet during the next three months. Hereafter the full list of meetings and conventions will be published only in the first issue of the Railway Age Gazette for each month.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Chas. W. Hunt, 220 W. 57th St., New York. Regular meetings, 1st and 3d Wednesday in month, except June, July and August, 220 W. 57th St., New York.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.—J. R. Wemlinger, 11 Broadway, New York. Regular meetings, 2d Thursday in month, at 2 P. M., 11 Broadway, New York.

AMERICAN WOOD PRESERVERS' ASSOCIATION.—F. J. Angier, B. & O., Mt. Royal Sta., Baltimore, Md. Next convention, January 19-21, 1915, Chicago.

ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 75 Church St., New York.

CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk, P. O. Box 7, St. Lambert (near Montreal), Que. Regular meetings, 2d Tuesday in month, except June, July and August, Windsor Hotel, Montreal, Que.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, 176 Mansfield St., Montreal, Que. Regular meetings, 1st Thursday in October, November, December, February, March and April. Annual meeting, January, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 Lawler Ave., Chicago. Regular meetings, 2d Monday in month, except July and August, Lytton Bldg., Chicago.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York. Regular meetings, 2d Friday in January, May, September and November. Annual meetings, 2d Thursday in March, Hotel Statler, Buffalo, N. Y.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—Elmer K. Hiles, 2511 Oliver Bldg., Pittsburgh, Pa. Regular meetings, 1st and 3d Tuesday, Pittsburgh.

GENERAL SUPERINTENDENTS' ASSOCIATION OF CHICAGO.—A. M. Hunter, 321 Grand Central Station, Chicago. Regular meetings, Wednesday, preceding 3d Thursday in month, Room 1856, Transportation Bldg., Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meetings, 2d Tuesday in month, except June, July, August and September, Boston.

NEW YORK RAILROAD CLUB.—Harry D. Vought, 95 Liberty St., New York. Regular meetings, 3d Friday in month, except June, July and August, 29 W. 39th St., New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—E. Frankenberger, 623 Brisbane Bldg., Buffalo, N. Y. Meetings monthly.

PEORIA ASSOCIATION OF RAILROAD OFFICERS.—M. W. Rotchford, Union Station, Peoria, Ill. Regular meetings, 2d Thursday in month, Jefferson Hotel, Peoria.

RAILROAD CLUB OF KANSAS CITY.—C. Manlove, 1008 Walnut St., Kansas City, Mo. Regular meetings, 3d Friday in month, Kansas City.

RAILWAY BUSINESS ASSOCIATION.—Frank W. Noxon, 30 Church St., New York.

RAILWAY CLUB OF PITTSBURGH.—J. B. Anderson, Room 207, P. R. R. Sta., Pittsburgh, Pa. Regular meetings, 4th Friday in month, except June, July and August, Monongahela House, Pittsburgh.

RICHMOND RAILROAD CLUB.—F. O. Robinson, C. & O., Richmond, Va. Regular meetings, 2d Monday in month, except June, July and August.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, 2d Friday in month, except June, July and August, St. Louis.

SALT LAKE TRANSPORTATION CLUB.—R. E. Rowland, Hotel Utah Bldg., Salt Lake City, Utah. Regular meetings, 1st Saturday of each month, Salt Lake City.

SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—E. W. Sandwich, A. & W. P. R. R., Atlanta, Ga. Next regular meeting, January 21, 1915, Atlanta, Ga.

SOUTHERN & SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Grant Bldg., Atlanta, Ga. Regular meetings, 3d Thursday, January, March, May, July, September, November, 10 A. M., Candler Bldg., Atlanta.

TOLEDO TRANSPORTATION CLUB.—Harry S. Fox, Toledo, Ohio. Regular meetings, 1st Saturday in month, Boody House, Toledo.

TRAFFIC CLUB OF CHICAGO.—W. H. Wharton, La Salle Hotel, Chicago.

TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 291 Broadway, New York. Regular meetings, last Tuesday in month except June, July and August, Waldorf-Astoria, New York.

TRAFFIC CLUB OF PITTSBURGH.—D. L. Wells, Erie R. R., Pittsburgh, Pa. Meetings bimonthly, Pittsburgh. Annual meeting, 2d Monday in June.

TRAFFIC CLUB OF ST. LOUIS.—A. F. Versen, Mercantile Library Bldg., St. Louis, Mo. Annual meeting in November. Noonday meetings October to May.

TRANSPORTATION CLUB OF DETROIT.—W. R. Hurley, Superintendent's office, L. S. & M. S., Detroit, Mich. Meetings monthly, Normandie Hotel, Detroit.

WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man. Regular meetings, 2d Monday, except June, July and August, Winnipeg.

WESTERN RAILWAY CLUB.—J. W. Taylor, 1112 Karpen Bldg., Chicago. Regular meetings, 3d Tuesday in month, except June, July and August, Karpen Bldg., Chicago.

WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, 1735 Monadnock Block, Chicago. Regular meetings, 1st Monday in month, except January, July and August, Chicago. Extra meetings, except in July and August, generally on other Monday evenings.

REVENUES AND EXPENSES OF RAILWAYS

MONTH OF OCTOBER, 1914

Name of road.	Average mileage operated during period.	Operating revenues			Operating expenses						Net operating revenue (or deficit).	Railway tax accruals.	Operating income (or loss).	Increase (or decr.) comp. with last year.
		Freight.	Passenger.	Total, inc. misc.	Maintenance of Way and structures.	Maintenance of equipment.	Traffic.	Transportation.	Miscellaneous.	General.	Total.				
Atlantic City	170	$67,740	$72,355	$153,599	$78,571	$17,619	$2,275	$87,365	$98	$1,361	$187,289	—$33,690	$13,500	—$47,242	$15,455
Boston & Maine	2,252	2,553,739	1,404,493	4,384,245	720,295	548,263	29,912	1,772,564	16,655	100,712	3,188,400	1,195,844	141,500	1,054,344	217,163
Delaware & Hudson	881	1,746,155	196,274	2,055,964	152,903	338,846	31,054	707,634	10,518	60,157	1,299,996	755,967	56,250	699,712	.....
Detroit, Toledo & Ironton	441	174,752	16,051	201,711	38,426	28,568	5,349	121,113	.....	6,170	199,627	2,084	6,000	—3,916	12,410
Kansas City, Mexico & Orient	740	181,925	40,453	234,941	39,344	26,353	8,889	80,198	.....	9,464	164,248	70,692	10,029	60,663	.....
Louisiana Ry. & Navigation Co	351	128,749	20,828	158,983	35,839	19,863	5,695	62,652	.....	5,674	129,723	29,260	7,500	21,760	7,638
Louisville, Henderson & St. Louis	200	84,112	33,961	127,438	25,008	18,597	6,014	41,565	.....	3,087	94,271	33,167	3,800	29,366	—5,999
Oahu Ry. & Land Co	109	45,354	22,241	74,648	12,058	8,013	589	20,116	.....	3,192	43,967	30,681	7,186	23,495	—10,387
Philadelphia & Reading	1,120	3,404,490	578,892	4,177,951	391,189	701,803	48,818	1,466,458	3,934	74,861	2,687,062	1,490,889	99,488	1,391,050	—297,830
Port Reading	21	115,218	.....	135,472	26,171	6,940	41	43,255	.....	163	76,570	58,903	12,000	46,903	—1,740
Ulster & Delaware	129	52,787	19,170	85,760	14,191	18,612	1,037	39,946	57	2,944	76,788	8,972	3,300	5,672	—6,013

FOUR MONTHS OF FISCAL YEAR ENDING JUNE 30, 1914

Name of road.	Average mileage operated during period.	Operating revenues			Operating expenses						Net operating revenue (or deficit).	Railway tax accruals.	Operating income (or loss).	Increase (or decr.) comp. with last year.
		Freight.	Passenger.	Total, inc. misc.	Maintenance of Way and structures.	Maintenance of equipment.	Traffic.	Transportation.	Miscellaneous.	General.	Total.				
Atlantic City	170	$295,233	$835,201	$1,177,253	$158,528	$101,369	$13,076	$507,271	$319	$7,337	$787,900	$389,353	$54,000	$335,265	—$32,897
Boston & Maine	2,252	9,476,432	6,301,538	17,268,920	2,838,653	2,648,639	162,734	7,004,316	75,815	378,478	13,128,635	4,140,285	645,210	3,495,075	—341,467
Delaware & Hudson	881	6,511,693	1,260,101	8,225,380	587,784	1,189,922	112,368	2,822,827	54,139	235,321	4,992,478	3,232,902	225,000	3,007,774	.....
Detroit, Toledo & Ironton	441	616,990	75,355	734,776	98,234	87,328	15,452	379,367	.....	23,806	604,186	130,590	24,000	106,590	278,438
*Kansas City, Mexico & Orient	351	520,516	94,091	656,577	137,196	67,839	22,730	251,385	.....	20,777	499,927	156,651	32,000	124,651	26,101
Louisiana Ry. & Navigation Co	351	334,641	150,248	517,630	106,311	72,285	21,625	161,605	.....	12,541	374,366	143,263	15,200	128,053	—3,705
Louisville, Henderson & St. Louis	200	377,907	92,981	496,642	43,150	38,368	2,476	89,874	.....	14,710	188,578	308,064	28,936	279,128	28,109
Oahu Ry. & Land Co	109	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Philadelphia & Reading	1,120	13,032,327	2,431,810	16,209,846	1,705,019	2,892,695	188,119	5,546,839	43,989	279,298	10,655,959	5,553,887	401,856	5,150,206	—558,992
Port Reading	21	405,522	.....	491,374	76,592	40,006	156	155,967	.....	1,902	274,623	216,751	48,000	168,751	—2,796
Ulster & Delaware	129	203,322	194,134	461,007	68,953	57,899	7,621	193,101	206	12,173	339,954	121,054	13,200	107,854	—27,748

*This company was reorganized July 6 and 8, 1914, hence cumulative figures are not shown.

Traffic News

Tariffs have been filed by the railways advancing the rates on copper bullion 50 cents a ton from the Missouri river and points west to the Atlantic seaboard and other eastern points.

The car ferry which is to run between Key West and Havana is expected to begin business about January 1, and the principal railroads in the southeastern states have issued their announcements, bidding for through freight.

The local freight agents of the railroads and boat lines in the city of Milwaukee will visit Chicago on Friday, December 18, for the inspection of the local freight offices and houses, and to attend a regular meeting of the Local Freight Agents' Association of Chicago. They will be entertained at a luncheon by the Chicago local freight agents.

A special train of 19 cars of mules for shipment to Europe moved over the Nashville, Chattanooga & St. Louis last week from Atlanta, Ga., to Nashville, Tenn., in record time. The shipment made the 289 miles in 11 hours and 55 minutes, or an average of 25 miles an hour. Over the same road a shipment of 20 cars of mules for Europe moved as a special train, making the run from Nashville to Jackson, Miss., 151 miles, in 7 hours and 6 minutes.

"The time has come when an appeal should be carried to Congress over the head of the Interstate Commerce Commission, for authority to make reasonable advances in freight and passenger rates." This view, expressed by Harry Scullin, president of the Scullin-Gallagher Iron & Steel Company, of St. Louis, is one which, he says, prevails in that region to some extent. Mr. Scullin's firm is a large shipper of freight, yet he advocates an increase in transportation rates because of the benefit to be derived by business generally.

The Southern Railway, complying with a request from the United States Department of Agriculture, has granted leaves of absence to Dr. C. M. Morgan, livestock and dairy agent of the company, Dr. Walter Sorrell, Dr. Morgan's assistant at Greensboro, N. C., and Dr. C. D. Lowe, assistant at Atlanta, to permit them to accept temporary service with the Department of Agriculture in the work being done to stamp out the foot-and-mouth disease among cattle. Drs. Morgan and Sorrell have had experience with the foot-and-mouth disease in the Philippine Islands. This far this disease has been found in only two states in the South—Virginia and Kentucky.

Railways in the western trunk line territory have announced their intention to charge full tariff rates on and after January 1, on shipments of supplies consigned from various sources for the relief of Belgians. The lines in the Trunk line and Central Freight Association territory have issued similar notices, that free transportation for donations for European war sufferers will be canceled on December 20. The railroads have already contributed very generously to this movement in the free transportation which has already been furnished, and in commitments which have been made for the immediate future. In the meantime, all interested parties have been notified that all shipments on which the railroads are committed to free or reduced transportation should be tendered for shipment prior to January 1. In order to facilitate the handling of such shipments arrangements were made by the western roads with the American Commission for the Relief of Belgium, the Rockefeller foundation and the Belgian Relief Committee, the principal societies handling this traffic, so that all shipments on which free or reduced transportation was given were consigned to the American Commission for the Relief of Belgium.

Freight Blockade at Galveston

J. H. Hill, vice-president and general manager of the Galveston, Houston & Henderson, and president of the Texas General Managers' Association, on December 11, gave out the following statement bearing on the congestion in the export traffic at Galveston, and on the demurrage question:

"On hand yesterday on Galveston island all lines, 1,767 cars, containing 2,000,000 bushels of wheat, and there is approximately the same amount in elevators A, B and the Star mills, making a total of 4,000,000 bushels on hand. The amount in transit all lines within a few days' movement from Galveston, is 2,000,000 bushels more. The heaviest month's export this season was 6,505,715 bushels. The Santa Fe has found it necessary within ten days after raising its former embargo to again embargo against wheat for Galveston in order that it might not only have facilities left in Galveston to handle its cotton and other commodities, but that its equipment might be available for the needs of its patrons.

"Neither the past nor present conditions indicate that the question of demurrage has taken one bushel of wheat from Galveston that Galveston could have cared for had there been no demurrage. The necessity for placing an embargo is much more harmful to a port than is demurrage. The latter in a great measure prevents the former."

Russo-Mongolian Railway Convention.—It is announced in Petrograd from Urga, that the Russian diplomatic agent in Mongolia has signed in Kyachta, on September 17-30 last, along with the authorized agents of the Urga government, an agreement respecting railways in Mongolia, to give effect to a project for connecting the Mongolian railways with the Siberian railways by constructing suitable connecting lines. The agreement recognizes the right of the Mongolian government to build railways within its own territory, and approves the construction of railways in Mongolia to serve the interests of both that country and Russia, which country will co-operate with the Mongolian government in giving effect to such a railway policy, in the form of practical assistance. The Russian government will not interfere with Mongolian railway construction if effected at the cost of the latter. But with respect to railway concessions, the Mongolian government, in virtue of the strictly friendly relations with its Russian neighbor, will, before giving a concession, consult with the Russian government with the object of obviating either economic or strategical injury to Russia in the granting of such concessions. Other conditions of the usual formal nature are attached to the convention, which has been duly signed, and copies exchanged in the Russian and Mongolian languages.

Cuban Railways' Results.—Although the development of German bounty-fed beet sugar practically ruined the sugar industry in the Greater Antilles, Cuba, unlike the other islands, consistently extended the cane plantations, whereas the others combined the fruit industry. The cane being less susceptible to weather conditions provides a more reliable article for railway traffic than fruit; but there is more fluctuation in its prices. Nevertheless, the railways have expanded and shown good results, and there is good reason to believe that the policy of retaining sugar and tobacco as the staple articles and main traffic feeders for the railways will eventually triumph. The summarized figures for the year 1913-14 show the financial position of the principal lines in which British and American capital is invested:

	Miles	Gross receipts	Inc. or dec.	Net receipts	Inc. or dec.	Op. ratio P.C.	Dividends P.C.
United Havana	680	$7,832,721	—$72,915	$3,213,724	—$380,820	58.97	5
Cuban Central	341	2,847,168	—154,383	1,057,905	—229,577	62.84	2
West'n Havana	147	1,393,386	+26,438	491,492	—67,627	64.73	7
Total	1,168	$12,073,275	—$200,860	$4,763,121	—$678,024		
Cuba Railroad	**602**	**$5,020,059**	**+$518,721**	**$2,401,734**	**+$248,268**	**52.16**	**6**

The set-backs shown in the table are due to an overproduction of beet. The first three lines form a group distinct from the Cuba Railroad, which is American owned. The United group shows decreases, but the balance sheets show a combined reserve of $3,376,800. On the other hand, the Cuba Railroad not only shows an increase in the year's turnover, but has paid 6 per cent, an increase of 2 per cent, though nothing is added to reserve. A recent rise in price of sugar will add materially to the traffic and financial prospects, since an increase of one cent a pound will represent a gain of about $50,000,000 to the revenue of the island.

Commission and Court News

INTERSTATE COMMERCE COMMISSION

The commission has suspended until April 15 proposed increased rates on live stock, fresh meats and packing house products from Chicago, St. Louis and other western centers to eastern cities. The new rates from Chicago to New York, for instance, would have been 33 cents per 100 lb. on cattle as compared with 28 cents, and on fresh meats 50 cents as compared with the present rate of 45 cents.

Dispute Concerning Divisions No Justification for Cancellation of Joint Rates

In re transit regulations on grain and dried beans at points on the Michigan Central. Opinion by Commissioner Daniels:

The commission finds that a dispute over divisions does not justify the Michigan Central in cancelling transit rules and joint rates on dried beans and grain from points on the Detroit & Mackinac, to points on the Michigan Central and its connections. (32 I. C. C., 39.)

Rates from Joplin, Mo.

Commercial Club of Joplin, Mo., v. Missouri Pacific et al. Opinion by Commissioner Clark:

Complaint is made that various rates to and from Joplin, Mo., are unreasonable and discriminatory, as compared with rates to and from Kansas City and Springfield, Mo. The commission finds that no testimony having been offered with respect to rates on newsprint paper from Minnesota points, or on petroleum and its products from Chicago rate points to Joplin, these rates cannot be considered. It also holds that the complaint as to commodity rates on imports from New Orleans and other Gulf ports, and commodity rates from points in Oklahoma, Arkansas, Louisiana and Texas to Joplin is not sustained by competent evidence. Existing class and commodity rates from St. Louis, Mo., to Joplin, applied as parts of through rates on shipments originating east of the Mississippi River are not found unreasonable or discriminatory; and it is held that no such similarity of traffic or transportation conditions exists between Joplin and Kansas City as to justify prescribing proportional rates to Joplin. The carriers are called upon, however, to correct certain inequalities growing out of abrupt increases in rates to points just beyond the limits of the application of so-called outbound jobbers' rates, from Joplin to points in Kansas, Oklahoma and Arkansas. (32 I. C. C., 226.)

STATE COMMISSIONS

The Nebraska Railway Commission, on December 8, denied an application of the Missouri Pacific to increase passenger fares in the state from two to three cents a mile. The commission said that the Nebraska two-cent fare law placed the subject outside the jurisdiction of the commission.

The Illinois Public Utilities Commission on December 9 issued an order in the industrial railways case in which the railways had canceled their allowances to industrial lines controlled by shippers. The commission holds that such lines are common carriers and are consequently entitled to receive allowances and to participate in through rates with the trunk lines.

At a meeting of the members of state railway commissions of eight western states held in Omaha, on December 12, it was agreed that these commissions should concentrate their resistance to proposed advances in freight rates by western railroads which have been suspended by the Interstate Commerce Commission, and that they would combine to engage accountants and other assistants to prepare their case. The commissions of Kansas, Nebraska, Iowa, Minnesota, North Dakota, South Dakota, Oklahoma and Arizona were represented.

The Illinois Public Utilities Commission has rendered a decision approving the proposed consolidation of the Lake Shore & Michigan Southern and its various subsidiaries with the New York Central & Hudson River. The commission in its opinion announces that it does not disapprove of unification, merging or consolidation of public service corporations in Illinois where it can be effected without violating some positive law. The commission also states that with such comprehensive regulatory laws as are now enforced in the states competition loses its force as a corrective agency. "It follows, therefore," the commission says, "that the general plan of consolidation proposed is in complete harmony with the modern idea of governmental regulation in control of public service corporations."

The Public Service Commission of Pennsylvania has ordered that a Certificate of Public Convenience issue approving consolidation and merger, in the matter of the petition of the Lake Shore & Michigan Southern, the Geneva, Corning & Southern, and the Dunkirk, Allegheny Valley & Pittsburgh, these to have leave to consolidate, with other railroad companies into the New York Central. Substantially the same action has been taken by the Public Service Commission of New York state. A protest against the merger was filed at Harrisburg by minority stockholders on the ground that it would be unconstitutional, but the commission's inquiry developed that the consolidation is not within the language of the prohibition in the constitution, inasmuch as no corporation consolidates with or purchases a competing or parallel line. The commission declares, however, that the legality of the action taken by the roads may be questioned at any time in a proper manner before a proper tribunal. The stock remains in precisely the same situation after such a merger as it was before; in fact, the merger is based upon a statutory right which exists even though the parties may have participated in many unlawful transactions. To refuse the merger would in no way correct the alleged wrong. If the commission were to assume jurisdiction of this question and should find the stock to be held illegally it ought to compel a disposition of such stock; but it has no such power. In fact, says, the commission, the contention appears to be based on the illogical thought that if a party to a controversy has committed offenses, he may be denied by way of penalty his legal rights. This, however, is not the law. Even a professional burglar may make a valid will.

Advances in Philadelphia Suburban Fares

The Pennsylvania Public Service Commission, following a hearing held in Philadelphia last week on the complaints of passengers relative to advances in suburban passenger fares which had been announced by the Pennsylvania, the Philadelphia & Reading and the Baltimore & Ohio, on Saturday issued a decision sustaining most of the items in the tariffs filed by the roads, except that the proposed advance of certain rates from one cent a mile to two cents or more is modified so as to make the increase only about five mills; or from 1 cent a mile to 1½ cents. The order, in substance, is as follows:

" . . . It is the judgment of the commission that the withdrawal from sale of the fifty and 100 trip individual commutation tickets, which have been maintained for many years, would unreasonably increase the fares paid by persons who have found these tickets suited to their needs.

"That 2¼ cents a mile is an unreasonably high basis for the charge for a ten-trip ticket, and

"That the sixty-trip monthly commutation ticket and the forty-six-trip monthly school ticket should be valid for a period of one month, and the 180-trip commutation ticket should be valid for a period of three months, all from date of issue, instead of being valid for periods of one and three calendar months only, as heretofore and proposed. . . . The proposed tariffs are unreasonable in making a charge of more than 2 cents a mile for ten-trip tickets.

"A reasonable scale of the charges for suburban passenger transportation in Pennsylvania is one providing for the scale of:

"One-hundred-trip individual tickets, sold at a rate not to exceed 1½ cents a mile, good six months.

"Ten-trip tickets, good for bearer and persons accompanying

bearer, sold at a rate not to exceed 2 cents a mile, good three months.

"Sixty-trip individual monthly commutation as proposed [increased 25 cents a month].

"The carriers are required to file proper tariffs to become effective December 15. . . ."

The Pennsylvania Railroad announced that it would acquiesce in the order.

Declaring that the simultaneous action of the three roads in advancing rates on the same day and to the same degree, gave evidence that they had been engaged in an illegal conspiracy, some of the objecting passengers had called upon the attorney-general at Washington to prosecute the roads under the anti-trust law; but whether this request will be followed up, does not appear.

The Interstate Commerce Commission did not suspend the interstate suburban rates, which were advanced simultaneously with those here dealt with.

Advanced intrastate tariffs filed in New Jersey (to Camden, across the river from Philadelphia) were suspended by the New Jersey commission.

PERSONNEL OF COMMISSIONS

Ross D. Rynder, chief examiner of the Interstate Commerce Commission, has resigned to become commerce counsel for Swift & Co. at Chicago.

George Welch, recently elected, becomes a member of the Tennessee State Railroad Commission on January 1, in place of Frank Avent, who has been a member of the commission for eight years.

John H. Roemer, chairman of the Wisconsin Railroad Commission, has announced his resignation, effective February 1, 1915. He is to take charge of the legal department of H. M. Byllesby & Co., Chicago.

COURT NEWS

The Manufacturers' Railway of St. Louis and the St. Louis Southwestern last week filed a petition in the United States district court at St. Louis for an injunction against the order of the Interstate Commerce Commission, fixing $2.50 a car as the maximum to be paid to the Manufacturers' Railway by trunk lines for switching cars over its line. The petition states that cars from the St. Louis Southwestern can be taken to certain industries only over the line of the Manufacturers' Railway, and that a rate of less than $4.50 a car is not sufficient to pay the Manufacturers' Railway enough to cover the expense.

Russian Railway Policy.—It is reported from Russia that fresh concessions to construct railways will not be granted. But those companies that have begun constructional operations will be allowed to continue. Those, however, with concessions who have not begun construction, will have to put off operations until the end of the war. It may be only a war measure; but it is not so stated.

Will the Railway Map of Africa be Revised.—Whatever may be one's personal opinion of Germany's fitness as a colonizing power, it must be admitted that no other nation, not even France, has realized more fully the imperative necessity of railway construction in colonial development work. As a result, the German railway schemes in her African colonies have been on a grandiose scale. Millions of money have already been spent on the construction of *lignes de pénétration*, together with port and harbor works. Not a single line has so far been productive, but none has been expected to yield a profit yet awhile; the railways have been planned under a policy of developing natural resources, and it is to be presumed that considerations of strategy have also not been overlooked. The question now is, whether other powers will not reap the harvest. A glance at the map of Africa shows that the German colonies are sandwiched in between those of Great Britain, France, Portugal and Italy. For instance, Togoland, together with the Gold Coast, forms an enclave in French territory. The ultimate disposal of these colonies, and their railways, is therefore an interesting subject for speculation.

Railway Officers

Executive, Financial, Legal and Accounting

M. Dailey, general manager of the Muscatine North & South Railway, has been appointed receiver, with office at Muscatine, Iowa.

H. K. Brooks, western manager of the financial department of the American Express Company at Chicago, has been elected vice-president, with headquarters at New York.

E. W. Beatty, whose appointment as vice-president and general counsel of the Canadian Pacific with headquarters at Montreal, Que., has already been announced in these columns was born on October 16, 1877 at Thorold, Ont., but moved with his parents to Toronto when he was ten years old. He is the son of the late Henry Beatty, a well known steamboat man in Canada. After graduating from the Toronto University he studied law in Toronto with a firm of which A. R. Creelman, who was his predecessor as general counsel of the Canadian Pacific was a member. In 1901 Mr. Beatty entered the legal department of the Canadian Pacific as one of the assistants to Mr. Creelman and in March, 1910, he was appointed general solicitor. He remained in this position until July 1, 1913, when he was appointed general counsel with headquarters at Montreal, Que., which position he held until his recent appointment also as vice-president.

E. W. Beatty

George Bury, vice-president in charge of the Canadian Pacific west of Lake Superior, who on January 1, will go to Montreal, Que.. to succeed David McNicoll as senior vice-president, was born on March 6, 1866, at Montreal, and was educated at the Montreal College. He began railway work in 1883, as a clerk in the purchasing department of the Canadian Pacific, and has been in the continuous service of that road ever since. From 1887 to 1889, he was secretary to vice-president, and secretary to president, then to March, 1890, was acting superintendent of dining, sleeping and parlor car service. From 1890 to September, 1899, he was successively assistant superintendent in charge of the division from Chalk River to Cartier and Sault Ste. Marie, and superintendent at North Bay, Ont. He was then superintendent at Fort William, Ont., until his appointment in February, 1901, as superintendent of the Crows Nest Pass division. From May, 1902, to 1905, he was general superintendent of the Lake Superior division and then was general superintendent of the

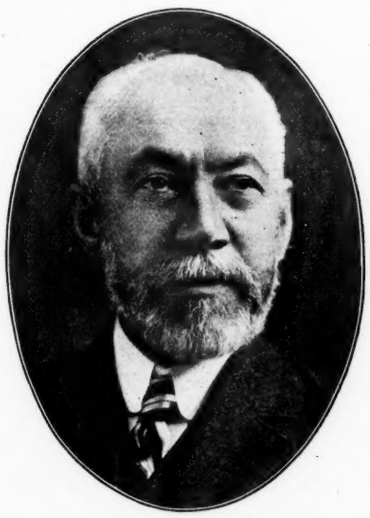
George Bury

Central division, until February, 1907, when he was appointed assistant general manager of the western lines of the Canadian Pacific, at Winnipeg, Man. On March 1, 1908, he was promoted to general manager of the western lines, and in October, 1911, he was elected vice-president and general manager of the same lines, and later was made vice-president in charge of the company's interests west of Lake Superior, with headquarters at Winnipeg, Man. On January 1 he will succeed David McNicoll, senior vice-president, with headquarters at Montreal, Que., and in his new office Mr. Bury will have jurisdiction over the entire system.

The offices of B. W. Fernald, auditor, and of H. Escherich, cashier, of the Tonopah & Tidewater and the Death Valley, have been removed from Oakland, Cal., to Los Angeles.

Thomas R. Beman, assistant general attorney of the Rock Island Lines, has been appointed general attorney. He will have charge of the preparation and approval of contracts. Wallace T. Hughes has been appointed assistant general attorney, and will continue in his present duties in matters relating to interstate commerce. A. B. Enoch has been appointed assistant general attorney, in charge of litigation in Illinois. Headquarters, Chicago.

David McNicoll, whose resignation from the position of senior vice-president of the Canadian Pacific, with headquarters at Montreal, Que., effective January 1 next, has already been announced in these columns, was born in April, 1852, at Arbroath, Scotland, and began railway work in August, 1866, as clerk in the goods manager's office of the North British Railway in Scotland. He remained in that position until 1873, when he went to the Midland Railway in England in the same capacity. The following year he went to Canada and was appointed billing clerk on the Northern Railway of Canada, and then from 1874 to 1881 was chief clerk in the general manager's office of the Toronto, Grey & Bruce, now a part of the Canadian Pacific. From 1882 to 1883 he was general freight and passenger agent of the same road, and then was general passenger agent of the Eastern and Ontario divisions of the Canadian Pacific until 1889, when he became general passenger agent of all lines, rail and steamship, of the Canadian Pacific. He was then appointed passenger traffic manager, remaining in that position until April, 1899, when he was appointed assistant general manager. One year later he was elected second vice-president and general manager and since December, 1903, was senior vice-president of the same road. Sir Thomas G. Shaughnessy, president of the Canadian Pacific, in announcing the resignation of Mr. McNicoll, said that he desired to be relieved of the duties of vice-president in order to rest and recuperate, but he will remain on the board of directors and when his health permits it is expected that he will be asked to accept another important post in connection with the company's affairs.



D. McNicoll

Operating

J. S. Gillespie has been appointed acting general superintendent of the Columbus & Southern, with headquarters at Laurelville, Ohio, succeeding I. F. Anderson, general superintendent, resigned.

R. F. Ledford, assistant division superintendent of the Beardstown division of the Chicago, Burlington & Quincy at Centralia, Ill., has been transferred to St. Joseph, Mo., as assistant superintendent of the St. Joseph division. M. C. Hughes, trainmaster at St. Joseph, succeeds Mr. Ledford.

It is announced that the offices of assistant superintendent of telegraph and assistant signal engineer of the Baltimore & Ohio Southwestern and the Cincinnati, Hamilton & Dayton are abolished. E. T. Ambach, assistant signal engineer of these roads, has been appointed assistant superintendent of telegraph and signals, with headquarters at Cincinnati, Ohio, effective December 15.

Albert D. Caulfield, trainmaster of the Illinois Central at Water Valley, Miss., has been appointed superintendent of the Mississippi division, with headquarters at Water Valley, succeeding John M. Egan, who has been granted leave of absence. The jurisdiction of Ned W. Spangler, trainmaster at Water Valley, has been extended to include Jackson, Water Valley and Grenada districts.

Traffic

R. W. Hunt, superintendent of ticket collections of the Southern Railway, has been appointed division passenger agent, with headquarters at Nashville, Tenn.

W. B. Wheeler, general western passenger agent of the Lehigh Valley at Buffalo, N. Y., having resigned to enter the service of the United Fruit Company, his former position has been abolished, and Norman W. Pringle, New England passenger agent at New Haven, Conn., has been appointed division passenger agent at Buffalo.

W. B. Hinchman, general agent of the Tonopah & Tidewater, has been appointed assistant to traffic manager of that road and the Death Valley, with headquarters at Los Angeles, Cal. D. Aspland, general agent at Goldfield, Nev., has been transferred to San Francisco, Cal., and H. R. Grier, assistant general agent at Tonopah, Nev., has been appointed general agent at that place. The office of F. M. Jenifer, traffic manager, has been removed from Oakland, Cal., to Los Angeles.

Albert J. Simmons, whose appointment as assistant general passenger agent of the Lehigh Valley, with headquarters at New York, has already been announced in these columns, was born on June 2, 1861, at London, Eng., and began railway work in 1872 as an office boy on the Pennsylvania Railroad. He was subsequently clerk on the St. Louis, Iron Mountain & Southern, then clerk on the Wabash, St. Louis & Pacific at New York, and in 1880 was appointed soliciting freight and passenger agent of the Union Pacific, at Boston, Mass. He was later New England agent of the Baltimore & Ohio, and then was New England passenger agent of the Lehigh Valley at Boston. In December, 1904, he was appointed general eastern passenger agent at New York, which position he held at the time of his recent appointment as assistant general passenger agent, as above noted.

A. J. Simmons

Engineering and Rolling Stock

Joseph Korvol has been appointed roadmaster of the Northern Pacific at Sedro Woolley, Wash., in place of W. J. Calvin, resigned.

A. D. Brice, assistant to the master car builder of the San Antonio & Aransas Pass, has been appointed master car builder, with headquarters at Yoakum, Tex., succeeding W. T. Cousley, resigned.

J. A. Cassady, master mechanic of the Alabama Great Southern at Birmingham, Ala., has been appointed master mechanic of the Cincinnati, New Orleans & Texas Pacific, with office at Somerset, Ky., succeeding H. B. Hayes, who has been transferred to Birmingham as master mechanic of the Alabama Great Southern, succeeding Mr. Cassady.

OBITUARY

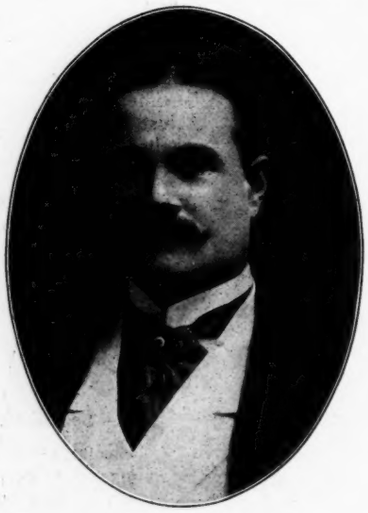
Charles J. Eddie, formerly for 16 years general western agent of the Chicago, Milwaukee & St. Paul, died at his home in Chicago on December 10, aged 70 years.

F. Wetherald, special passenger agent of the Chicago, Burlington & Quincy at Boston, Mass., died in that city on December 8. He had been connected with the Burlington since 1856. He was traveling passenger agent from 1876 to 1893, when he was appointed special passenger agent at Boston.

Frederick A. Nash, general western agent of the Chicago, Milwaukee & St. Paul, at Omaha, Neb., died on December 11, aged 66 years. Mr. Nash was born at Akron, Ohio, and had been in railway service since September, 1867. He was with the Union Pacific until 1882, when he went to the Chicago, Milwaukee & St. Paul as general agent at Omaha. In 1897 he was appointed general western agent.

Henry S. Hayward, consulting engineer floating equipment of the Pennsylvania Railroad, with headquarters at New York, died on December 14 at Augusta, Ga., at the age of 70. He began railway work in April, 1873, as a machinist and draftsman on the Pennsylvania Railroad, and since January, 1912, was consulting engineer floating equipment of the Pennsylvania Lines east of Pittsburgh. Mr. Hayward's entire service of over 40 years had been with the Pennsylvania Railroad.

William D. Cantillon, formerly general manager of the Chicago & North Western, died at his home in Chicago on December 13. Mr. Cantillon was born on August 5, 1861, at Janesville, Wis., and was connected with the North Western continuously for 36 years, resigning last May on account of ill health. He began railway work with that road as brakeman in 1878. He was afterwards conductor, and from 1891 to 1893 was trainmaster at Milwaukee, Wis. He was then for four years assistant superintendent at Milwaukee, and was made division superintendent at Winona, Minn., in 1901. In July, 1902, he was promoted to assistant general superintendent, and in January, 1906, was appointed assistant general manager. Mr. Cantillon became general manager in November, 1910, which position he held at the time of his retirement last spring.



W. D. Cantillon

Colonel Edward D. Meier, formerly president of the American Society of Mechanical Engineers, died on December 15 in New York City at the age of 73. He was born in St. Louis, Mo., and graduated from Washington University in 1858. He subsequently spent four years in Germany at the Royal Polytechnic College in Hanover, and later became an apprentice at the Mason Locomotive Works, Taunton, Mass. After serving in the United States army during the civil war he entered the service of the Rogers Locomotive Works at Paterson, N. J. He subsequently was superintendent of machinery of the Kansas Pacific, now a part of the Union Pacific. In 1870 he became chief engineer of the Illinois Patent Coke Company, and two years later was secretary and construction engineer of the Meier Iron Company, and in 1884 organized the Heine Safety Boiler Company, of which he was president at the time of his death. Previous to 1908 he was president of the American Diesel Engine Company and introduced the Diesel motor into this country. He was president of the American Boiler Manufacturers' Association in 1898; president of the American Society of Mechanical Engineers in 1910, and in 1913 represented that society in Munich, at a joint meeting with the German Engineering Society.

Equipment and Supplies

LOCOMOTIVE BUILDING

THE LONDON & PORT STANLEY, London, Ont., has ordered 3 electric locomotives from the Canadian General Electric Company.

CAR BUILDING

THE CHICAGO GREAT WESTERN is in the market for 2 60-ft. postal cars.

PENNSYLVANIA RAILROAD.—The item in the *Railway Age Gazette* of last week that this company had ordered 1,050 all-steel box cars from the Altoona shops was in error, in that this was not a new order, but merely the authority to proceed with an old order which had been held in abeyance.

RAILWAY CONSTRUCTION IN THE BRAZILIAN STATE OF RIO GRANDE DO SUL.—There are now in operation in the Brazilian state of Rio Grande do Sul 1,489 miles of railway and about 200 miles more will be opened to traffic before the end of the present year. In April last the president of the state published a decree setting forth the plans for the extension of the government lines, on which work will commence soon. These lines, as proposed, will open up some of the wealthiest lands in the state.

THE SIERRA LEONE GOVERNMENT RAILWAYS.—The Sierra Leone Government Railways are in the unusual position among African railways of having a 2 ft. 6 in. gage. The main line runs from the port of Freetown to Pendembu; and an extension of 30 miles from Yonni Banna to Makump was opened for traffic in February, 1913. There is also a mountain railway from Freetown up the Lion Rock, a distance of 6 miles, which is worked by adhesion and has a general grade up the mountain of 3.33 per cent. With the extension, the total length of line is now 300 miles. The recently published report of the general manager for the year 1913 shows satisfactory results. Gross receipts, $818,511, showed an increase of $127,677, and the net earnings, $380,358, were $57,460 better, giving a return of 5.78 per cent on capital expenditure. The percentage of operating expenses to receipts was 53.53. As usual, the principal item of outbound freight traffic was palm kernels, of which 25,820 tons were carried, earning $327,545 in 1913, as compared with 22,016 tons and $283,090 in 1912. The highest rated inbound traffic was spirits, of which 2,746 tons were carried, earning $66,412. A revised tariff with certain reductions in passenger fares and alterations in freight rates is in course of preparation.

SOME NOTES ABOUT ARMORED TRAINS.—It would be an interesting problem for military historians to determine when the idea originated of using the railway trains as weapons of offence. The British have been familiar with the armored train since the campaign in South Africa. In fact, it was in connection with a little affair at Estcourt, in which an armored train figured so prominently, that some of the first shots of the war were fired. As a weapon of offence, the armored train possesses two very remarkable and outstanding advantages. It has remarkable mobility, and is easy to construct, the sole requirements being suitable light guns and metal plates or sheets for the protection of the locomotives and rolling stock employed. Public attention has lately been more focussed on the more spectacular armored motor car, which has really done remarkable execution, but this weapon is not of much use save for very effective scouting and in roadside skirmishes. The armored train, on the other hand, is really a mobile fort, capable of traveling at a speed far in excess of that attainable by any army, and able, like a man-of-war, to discharge a broadside when in motion. Accounts would seem to indicate that the problem of taking up the recoil has not yet been solved entirely, but the difficulties experienced in that respect appear neither serious nor insuperable.

Supply Trade News

The Concrete Mixing & Placing Company, 123 W. Madison street, Chicago, which has formerly handled the pneumatic mixer and conveyor in western territory, now has extended its business to cover the entire country.

The Mesta Machine Company, Pittsburgh, Pa., has recently acquired the rights from the Stumpf Una-Flow Engine Company, Syracuse, N. Y., to build the Stumpf Una-Flow type of engine in the United States. The agreement not only gives the Mesta Machine Company the patent rights of Professor Stumpf, but includes the use of the knowledge gained by the practical experience of European builders of Stumpf engines.

Arthur E. Jackman has been appointed manager of the machinery department of the Walter A. Zelnicker Supply Company, St. Louis, Mo., succeeding J. J. Hilpirt, who has resigned to become storekeeper of Cia. Mexicana De Petroleo, "El Aguila" S. A. at Tampico, Mex. Mr. Jackman was at one time general manager of the Sea View Railroad and the Narragansett Pier Electric Light & Power Company. He was also for years in the railway and lighting department of the Westinghouse Electric & Manufacturing Company, and left the position of superintendent of the East St. Louis, Columbia & Waterloo Railway to assume his present duties.

H. C. Hequembourg, whose election to the vice-presidency of the Standard Chemical Company, Pittsburgh, Pa., has been announced in these columns, was born in St. Louis, Mo. He received his education at Dunkirk, N. Y., and spent the first 21 years of his business life with the Brooks Locomotive Works of that city in the positions, respectively, of bookkeeper, cashier and assistant secretary. When the American Locomotive Company was incorporated in June, 1901, he was made its general purchasing agent, and has remained in that position up to the acceptance of his new appointment. The Standard Chemical Company is a refiner of carnotite ores and produces radium, uranium and vanadium. Mr. Hequembourg as vice-president of the company will be its representative in the east and will have headquarters at 30 Church street, New York. He will also represent the American Vanadium Company in the east. Mr. Hequembourg during his many years with the American Locomotive Company has made many friends in New York, and it is with pleasure that they learn that he will continue to have his offices in that city.

H. C. Hequembourg

The fire that destroyed part of the Edison Phonograph Works at Orange, N. J., on December 9 did not in any way affect the Edison Storage Battery Company. One end of the large concrete buildings of the battery works is across the street from Mr. Edison's private laboratory, which was saved, and this as well as the rest of the plant escaped unscorched. The fire started about 5:20 in the afternoon and was under control by 10 o'clock. The telephone exchange was in one of the burned buildings, but through the prompt action of the New York Telephone Company a temporary switchboard was working in the battery office before business hours the next morning and the Public Service Electric Company had emergency lines furnishing power nearly as soon. The business of the Edison Storage Battery Company, therefore, suffered no interruption whatever.

Railway Construction

ATLANTA, BIRMINGHAM & ATLANTIC.—A contract has been given to Thomas Worthington, Birmingham, Ala., to build a freight line to serve coal mines from Roebuck, Ala., to Coalmont, 1.5 miles.

CANADIAN PACIFIC.—An officer of the Esquimalt & Nanaimo writes that surveys have been made and the right of way partly cleared for an extension from Courtenay on Vancouver Island, B. C., to Campbell River, 30 miles.

CHARLES CITY WESTERN.—Plans are being prepared for the extension of this line from Charles City, Iowa, in a northeasterly direction, a distance of 18 miles. This work is to be done next spring in connection with the electrification of the present line. E. R. Ernsberger, Charles City, Iowa, is general manager.

CHARTIERS SOUTHERN.—An officer writes that grading work is about finished and the bridge masonry and tunnel work have been completed on the line from a point near Eighty Four, Pa., south to a point near Marianna, 10.27 miles, but further work has been indefinitely postponed. Contracts were let in 1913 to the Brocklehurst & Potter Company, New York, to build the line. E. V. Braden is engineer, Pittsburgh, Pa.

CHICAGO, MILWAUKEE & ST. PAUL.—Extended improvements are being planned by this company at Mason City, Iowa, but work will not be started until next spring.

EASTERN MAINE.—An officer writes that this company is making surveys from the line from Bangor, Me., to Houlton, about 112 miles, and has just completed the location of the section from Bancroft to Houlton, 32 miles. G. W. Maxfield, president, Bangor. (October 9, p. 670.)

ERIE.—An officer writes that this company and subsidiary lines will carry out double tracking work as follows: Between Allegany, N. Y., and Carrolton, 5.6 miles; Chicago & Erie between Lomax, Ind., and Griffith, 36 miles; Sharon Railway, between Ferrona, Pa., and West Middlesex, and between New Castle Waterworks and New Castle Junction, 12 miles; Nypano Railroad from Steamburg, N. Y., to Waterboro, 9 miles, and Cleveland & Mahoning Valley, on the Canal branch, from Youngstown Ohio, to Girard, 5 miles.

ESQUIMALT & NANAIMO.—See Canadian Pacific.

FRESNO INTERURBAN (Electric).—A line is being built from Fresno, Cal., to Las Palmas, 5 miles, and from thence to Centerville, 16 miles. There will also be a branch running from Las Palmas to Clovis, 5 miles. Grading will amount to about 6,000 cu. yd. a mile. The line will cross seven main irrigation canals on framed trestles, each about 60 ft. long. Work is about 30 per cent completed.. Mahoney Brothers, San Francisco, are the general contractors. John B. Rogers, San Francisco, is president of the railway company.

GULF, FLORIDA & ALABAMA.—An officer writes that in addition to the extension now being built from Broughton, Ala., north to Kimbrough, 52 miles, on which work is now under way by the Eastern Construction Company, Pensacola, Fla., the company has located 145 miles from Kimbrough to Tuscaloosa. The company now operates a 90-mile line from Pensacola, Fla., north to Broughton, Ala., and a 11-mile branch line.

ILLINOIS CENTRAL.—An officer writes that the improvements now under way include grade reduction and second track work between Princeton, Ky., and Dulaney on 11.10 miles; relocation of 5.25 miles at Iron Hill, and grade reduction at Grand Rivers on 0.60 miles. The contractors are H. C. Hodges, Birmingham, Ala.; Winston Brothers Company, Minneapolis, Minn., and the Walsh Construction Company, Davenport, Iowa. Grade separation work is also under way on 1.37 miles at Matoon, Ill. J. D. Lynch, Monmouth, Ill., is the contractor.

MIDLAND CONTINENTAL.—An officer writes that surveys are now being made for an extension from Wimbledon, N. D., to Grand Forks, 94.5 miles.

NEVADA SHORT LINE.—We are told that this company is building a 3-ft. gage line to be 12 miles long, from Oreana, Nev., or Nenzel on the Southern Pacific to the new mining camp of Rochester. About nine miles has been completed. A. A. Codd, president and general manager, Reno, and R. E. Tilden, chief engineer, Winnemucca, Nev.

OTTAWA & ST. LAWRENCE ELECTRIC.—A grading contract is reported let to Eastman, Kenny & Stearns, Russell, Ont., to build the section between Russell and Metcalfe. The company made plans about two years ago to build 275 miles of railway out of Ottawa, and to use gas-electric cars for operating the line. H. W. Pearson, Confederation Life building, Toronto, is secretary.

SALT LAKE & OGDEN (Electric).—An officer writes that 1.06 miles of new line will be built from the present terminal at Salt Lake City, Utah, to the new terminal, to be used jointly with the Salt Lake & Utah, and 0.33 miles will be built at Ogden to connect with the new terminal to be used jointly with the Ogden, Logan & Idaho.

SEATTLE, PORT ANGELES & LAKE CRESCENT.—The grading, bridge work, etc., are being completed on the new line from Port Angeles, Wash., eastward to the line of the Port Townsend Southern, 37 miles. C. J. Erickson, Seattle, Wash., is the general contractor. The track will be laid by company forces. This stretch of new road is part of the original proposed line which extends from a point 25 miles west of Port Angeles through Port Angeles eastward via Sequim to a connection with the Port Townsend Southern at the head of Discovery Bay, 37 miles, and then to a terminus on Puget Sound, not yet selected. Work on this last section, which is 12 to 15 miles long, has not yet been begun. E. O. Reeder, Seattle, Wash., is chief engineer.

SOUTH DAKOTA CENTRAL.—An officer of this company, which operates a line from Sioux Falls, S. D., north to Watertown, 102.8 miles, writes that a contract has been given to P. E. Shugart, Nevada, Iowa, to build an extension from Watertown north to the Chicago, Milwaukee & St. Paul, 28 miles.

RAILWAY STRUCTURES

BOONE, IOWA.—The Ft. Dodge, Des Moines & Southern has started the work of replacing the wood bridge spanning the Des Moines river between Boone and Fraser, with steel deck girders placed on concrete abutments and piers. There will be six spans. The concrete work on the south abutment and three piers has just been completed, and the deck girders for these spans have been ordered, and when in place will replace all of the pile trestle work up to the old Howe truss. This will constitute all the work that is contemplated at the present time, but it is stated that if financial conditions permit the bridge will be completed in 1915. The concrete work is being done by company forces.

CHICAGO, ILL.—The Illinois Central has commenced the construction of a hospital and power house to be located on Stony Island avenue, between Fifty-seventh and Fifty-ninth streets, Chicago. The main building will be 266 ft. long, 47 ft. wide and four stories high, with a rear wing 59 ft. by 47 ft. in area two stories high. The power house, which includes the laundry, will be 89 ft. by 48 ft. in area and two stories high. Both buildings will be of brick and stone construction and strictly fireproof. The estimated cost is $300,000. Schmidt, Garden & Martin, Chicago, are architects, and James Stewart & Co., are the general contractors. The foundations are already in place and the entire work is to be completed by October, 1915.

PARSONS, KAN.—Work is to begin at once on the construction of a brick office building of the Missouri, Kansas & Texas, at Parsons, Kan. The building will be 51 ft. by 179 ft. in area and three stories high. The estimated cost is $50,000. The Wimmer Contracting Company, St. Louis, Mo., has the general contract.

ST. PAUL, MINN.—The directors of the St. Paul Union Depot Company have reached an agreement on plans for the construction of the proposed new union depot to cost between $12,000,000 and $15,000,000, and have announced that the final plans will be ready to be submitted to the city authorities in about two weeks.

Railway Financial News

BUFFALO, ROCHESTER & PITTSBURGH.—The New York Public Service Commission, Second district, has approved of an issue of $1,020,000 4½ per cent consolidated mortgage bonds of the Buffalo, Rochester & Pittsburgh at a price to be fixed later.

CHICAGO & NORTH WESTERN.—Kuhn, Loeb & Co., New York, bought from the Chicago & North Western and resold to the public $10,000,000 general mortgage 5 per cent bonds due November 1, 1987. The offering price to the public was 102½, the yield on this basis being about 4⅞ per cent.

ILLINOIS CENTRAL.—Kuhn, Loeb & Company have bought from the Illinois Central and resold $5,000,000 Chicago, St. Louis & New Orleans 5 per cent equipment trust notes guaranteed by the Illinois Central. The notes were offered by the bankers at par and were oversubscribed.

MICHIGAN CENTRAL.—A semi-annual dividend of 1 per cent has been declared, payable January 29. This reduces the annual rate from 6 per cent to 2 per cent, in 1914 a total of 4 per cent having been declared. The annual rate has been 6 per cent since 1907.

PENNSYLVANIA RAILROAD.—See Vandalia.

ST. LOUIS & SAN FRANCISCO.—The receivers are making arrangements to sell $3,000,000 6 per cent receivers' certificates to refund the $3,000,000 receivers' certificates which mature on January 1.

SOUTHERN RAILWAY.—Holders of the outstanding $4,722,000 Richmond & Danville consolidated mortgage 6 per cent bonds which mature on January 1, 1915, are offered the privilege of exchanging these bonds for Southern Railway first consolidated 5's at 98½.

VANDALIA.—The regular annual dividend of 4 per cent, which is This price is $1,500,000 less than the price fixed for the former usually declared at this time of the year, has been passed. The Pennsylvania owns $12,114,000 of the total $14,614,000 stock of the Vandalia.

WHEELING & LAKE ERIE.—Judge Clarke, in the federal district court, has fixed the upset price for the sale of the Wheeling & Lake Erie at $18,500,000, the road to be sold before April, 1915. sale, at which there were no bidders.

TURKS SEIZE A BRITISH RAILWAY.—A Constantinople message states that the Turkish government has confiscated the Ottoman (Smyrna to Aidin) Railway.

NEW RAILWAYS CONSTRUCTED IN GERMANY.—According to the *Nieuwe Rotterdamsche Courant,* the Germans have been amazingly busy creating a network of strategic railways. It is stated that between Berlin and Cologne no fewer than eight sets of railway lines have been laid down.

STRATEGIC RAILWAY IN SOUTH AFRICA.—The construction work on the railway from Prieska to Upington, on the northwest border of the Cape Province, has now been completed, and the first train went through on November 18. The line, 142 miles in length, follows approximately the course of the Orange river, and is of considerable military and strategic importance.

RAILWAY CONSTRUCTION IN FRENCH CONGO.—In order to avoid the present necessity of using the Belgian railway (Matadi-Leopoldville) for transporting passengers and freight to Middle Kongo and the Ubangi-Tchad colonies, France has resolved to construct a railway from Pointe-Noir on the Atlantic coast inland to Brazzaville, in the neighborhood of Stanley Pool on the Congo river, and an appropriation amounting to about $18,000,000 has been voted toward the project by the French Chamber. This will probably have little effect upon the transport of merchandise for Belgian Congo, but the Matadi-Leopoldville line will lose the French traffic and possibly a considerable portion of that for the southern part of German Kamerun.